THE IRON TRADE REVIEW

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THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The important news of the week is the official announcement by the Carnegie Co. that it will establish at Conneaut Harbor, O., a great plant for the manufacture of wrought pipe and tubes, and with it the necessary blast furnaces and steel works. That the company would make a departure from its widely published and presumably settled policy of centering its manufacturing operations in the Pittsburg district, has been rumored at intervals ever since the establishment of its docks at Conneaut. Denials so regularly followed these announcements that the trade was entirely unprepared for the news that has just come. Many months will be required for the carrying out of the plans, but the ultimate outcome will only make plain what has been affirmed from the beginning, that the consolidations in iron and steel, in whatever line, will have abundant competition, and that the consumer will be amply protected against high prices. For the present the taking up of so ambitious a project as that which will be worked out at Conneaut may relieve the apprehension some other interests have had over the possible entrance of the Carnegie Co. upon their field. The year is not yet old enough for any market developments of significance. Finishing mills are so heavily loaded with orders that some of them will not be seeking business for many weeks. On the other hand, many consumers have supplied their wants for most of the first half of the year. The situation in this department of the market is very firm, but it would seem that the large interests are averse to any policy as to prices that does not appear fully justified by conditions. At the meeting of plate manufacturers last week, though there was a sentiment in favor of an advance of $1 a ton, the mills most under pressure yielded their opinions and no change was made. Concerning bilets the report went out that an advance was talked of, but the fact is, no such idea was entertained. There is reason for skepticism, also, as to the report that an advance of $2 a ton in rails is being considered. There are important producing interests which would regard such a step at this time as a mistake. While the mills have taken good orders for 1901, they have not reached the point at which they are ready to take a step that would curtail rail purchases after all the difficulty experienced in getting on the books the tonnage already there. These have been several good purchases the past week, and the prospects are good for adding to them in the near future. The building outlook is everywhere reported bright. An 8,000-ton contract in Chicago closed the past week is a forerunner of extensive operations in that city, and in the East some conspicuous enterprises are advancing toward the contract stage. Structural steel manufacturers found no difficulty in agreeing to continue the present pool for another year, with the avowed policy of keeping prices where the largest volume of business will be encouraged. Pig iron still lags behind finished material, and there is no immediate indication of a change in its position. Bessemer furnacemen are philosophically accepting the situation and simply waiting. Meantime the market for Bessemer iron is slightly lower. In foundry irons there is some variance in reports. As a rule prices are being well held, though here and there furnaces recently resuming are pushing for business. Consumers are taking iron freely on their contracts and the general report indicates an increasing melt in the foundries of the country. Considerable additional buying is expected for the needs of the first half of the year, but a good many consumers are acting on the presumption that lower raw materials will give lower pig iron. Supply and demand will determine that question entirely. No interest is shown by furnace companies in ore prices for next year. It is not to be taken for granted that there will be an agreement on Bessemer ores unless it be made all-inclusive, which was not the case last year. Old range Bessemers, it is agreed, will command a good price in any event, but the contest over Mesabi ores, of which there will be an unheard of output, may even widen the gap that has always existed between the old-range and new-range products.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
429 PARK BUILDING, Jan. 9.

The announcement made by the Carnegie Steel Co. that it would erect a great tube plant at Conneaut Harbor, O., took Pittsburg by surprise. It has been known for some time that the company intended to add tubular goods to its present finished product, but none ventured to guess that the plant would be located outside of the Pittsburg district. The stupendous expenditure also involved is almost as great as the outlay of the company during the last year in improvements in the Pittsburg district. Elsewhere are published some details of the plant to be built.

At the meeting of the steel manufacturers held in New York last week no advances were made either on steel billets or plates. Prices were reaffirmed and all present felt satisfied that conditions were such that a good year's business would be done. Owing to the fact that many of the western mills were well filled up on plate orders, some of the representatives at this meeting favored a slight advance, but the majority believed that it would be the wisest policy to let prices remain as they were for the present at least. So far as steel billets are concerned, the manufacturers went to the meeting without any intention of an advance. There has been some talk during the week about an advance to be made in the price of steel rails. So far as can be learned there is no concerted sentiment on the subject among the manufacturers. The meeting of the shafting manufacturers held last week resulted in an advance of 2 per cent. The price of shafting has been relatively lower than other finished products for some time and the trade considers the recent advances as only in keeping with the conditions. The beam agreement was again ratified and the structural steel manufacturers will maintain uniform prices until 1902. The present price was reaffirmed. A meeting of the Bessemer Association was held in Cleveland, but no action was taken with regard to prices. Several meetings of the pig iron producers in the Shenango valley were held for the purpose of considering a change in the plan of paying the iron carriers at the furnaces. In the Mahoning Valley the carriers are paid by the day, while in the Shenango valley they are paid by the ton. The men make larger earnings by

the latter method than by the former and if the change occurs it will mean a reduction of more than 25 per cent. Another meeting will shortly be held at which it is probable this will be done.

The past week has been comparatively quiet in iron and steel circles in this district. There has been a fair demand for finished material and buyers of all kinds of pig iron secured somewhat lower prices than ruled a week ago. Bessemer again rules lower and what iron was sold will probably be taken from the stock piles in the valleys. While contracts for furnace coke for the first half of the year were numerous during the week, not all the furnacemen by any means have closed up and some of them are reported to be buying coke from week to week, expecting lower prices. The present figures are considered very low by the coke producers who aver that they would sooner close some of their plants than sell below the basis now ruling. During the week the National Tube Co. acquired control of the plant of the Standard Seamless Tube Co. at Ellwood City, Pa. This is one of the best equipped and largest seamless plants in the country and will place the National Tube Co. in position to compete for any kind of business in this line.

PIG IRON.—The sales of Bessemer iron during the week amounted to several thousand tons at prices ranging from $13 to $13.25 per ton. Most of the iron that is being sold for Pittsburg delivery is being taken from stocks at the Valley furnaces. Foundry iron is also lower in this market, prices ranging from $14 to $14.25. We note the sale of 1,500 tons of forge iron at $13, delivered Pittsburg and of a small lot at $13.35. We revise quotations as follows:

Bessemer, Pittsburg	$13.00 to $13.25
No. 1 Foundry	14.50 to 15.00
No. 2 Foundry	14.00 to 14.25
No. 3 Foundry	13.50 to 14.00
Gray Forge, Pittsburg	13.00 to 13.35

STEEL.—Sales of several thousand tons of steel billets were made during the past week at ruling prices. The meeting of the steel billets interests last week resulted in no advance and none of the manufacturers contemplated making one notwithstanding reports to the contrary. Prices were reaffirmed as follows: 4x4 billets, delivered, Pittsburg, Wheeling or Valley at $19.75. On less than 4-inch billets down to 1½-inch $1 extra is charged. Open-hearth billets are $1 per ton above Bessemer billets at all delivered points. Sheet and tin bars are $1 above Bessemer billets.

RAILS AND TRACK MATERIAL.—Reports have been circulated during the past week that an advance in the price of steel rails was being contemplated. If such a movement is on foot the manufacturers are not aware of it. At the steel meeting last week steel rails were not even discussed. No new business in standard section rails was placed during the week. The price of 40 pound rails was advanced during the week to $28 and other light rails are proportionately higher. Mills rolling light rails are filled up to such an extent that they are unable to make deliveries for at least a month. We revise our quotations as follows: Rails, standard sections, 50 pounds and over, in lots of 200 tons and over, $26; car lots and less than 200 tons, $28; less than car lots, $30; 8 to 12 pounds, $30; 16 to 20 pounds, $29; 25 to 40 pounds, $28. Track material: Spikes, 1.70c to 1.75c; track bolts, square heads, 2.25c; hexagon heads, $2.35c; fish plates, 1.40c to 1.50c.

FERRO-MANGANESE.—There is little doing in this product, domestic 80 per cent being held at $62.50 per ton, delivered at buyers' mill in carload lots.

MUCK BARS.—There has not been sufficient business during the past week to establish a price. Last sales noted were made at $25.50 delivered, Pittsburg.

SKELP.—Only a few small sales of skelp were made during the week. There is little demand for steel skelp, sales being almost entirely limited to iron. Iron skelp is held at 1.55c to 1.60c, while steel skelp is held at 1.35, delivered, Pittsburg.

BARS.—Some new business in bars was placed during the week and prices are somewhat firmer than for some time. While large desirable orders can be placed at 1.25c, small orders command as high as 1.35c to 1.40c. Mills are still behind on their deliveries and consumers are crowding in the specifications. Refined bars are held at 1.75 to 2c Pittsburg, while common iron bars are quoted 1.30, delivered, Pittsburg.

PLATES.—Contrary to expectations no advance was made in the price of plates at the meeting held in New York City last week. Some of the western producers were in favor of an advance, but the majority were in favor of reaffirming existing prices and this was done. The Carnegie Steel Co. has received a contract from the government for 4,000 tons of plates for the battleships Maine, Missouri and Ohio, now under construction. Considerable small business was also placed during the week. Prices are as follows: Tank plate, ¼-inch thick, up to 100 inches in width, 1.40c at mill, Pittsburg; flange and boiler steel, 1.50c; marine, ordinary firebox, A. B. M. A. specifications, 1.60; still bottom steel, 1.70c; locomotive firebox, not less than 1.90c, and it ranges in price to 3c. Plates more than 100 inches wide, 5 cents extra 100 pounds. Plates 3-16 of an inch in thickness, $1 extra; gauges Nos. 8 and 9, $2 extra. These quotations are based on carload lots, with 5 cents extra a hundred pounds for less than carload lots. Terms, net cash in 30 days.

SHEETS.—Demand for sheets continues strong and during the past week a number of large contracts were closed for delivery during the first half of the year at prices ranging from 2.95c to 3c for No. 28 guage black sheets. Galvanized sheets were strong. Our quotations unchanged are as follows: Black sheets, No. 28 gauge, one pass through cold rolls, 2.95c to 3c; No. 27, 2.85c to 2.90c; No. 26, 2.70c; No. 24, 2.60c; No. 22, 2.50c; No. 20, 2.40c; No. 18, blue annealed, 2.15c to 2.20c; No. 14, 1.90c to 2c; Nos. 11 and 12, 1.75c to 1.85c; No. 10, 1.65 to 1.70c; plates, gauges 8 and 9, 1.55c to 1.60c. Galvanized sheets continue to be held at 75 off with no freight allowance.

STRUCTURAL MATERIAL.—During the past week the McClintic-Marshall Construction Co. was awarded the contract for the erection of the structural steel work of the Marshall Field building in Chicago, requiring approximately 8,000 tons. The strike of the structural iron and steel workers has been practically settled, nearly all concerns affected having granted the demands of the men. At a meeting of structural steel manufacturers last week it was decided to continue the present agreement another year. Present prices were reaffirmed as follows: Beams and channels, 3 to 15 inches, 1.50c; 18 to 24 inches, 1.60c; tees, 1.55c; zees, 1.50c; angles, from 3 to 6 inches, 1.40c; universal mill plates, 1.40c.

PIPES AND TUBES.—During the past week the National Tube Co. secured a controlling interest in the plant of the Standard Seamless Tube Co. at Ellwood City, Pa. This new plant will give the National Tube Co. the largest capacity for producing seamless tubing of any plant in the country. Further details of the purchase are noted elsewhere. Demand for all kinds of tubular goods is good considering the season of the year and the largest producer has thus far been enabled to keep his plants in full operation. Prices are unchanged. Discounts to consumers in carload lots, Pittsburg, are as follows:

MERCHANT PIPE.

	Black. per cent.	Gal'vd. per cent.
⅛ to ⅜ inch and 11 to 12 inch	61	48
½ to 10 inch	68½	56

BOILER TUBES.

	22 Feet and under. Per cent.		Over 22 Feet. Per cent.	
	Iron.	Steel.	Iron.	Steel.
1 to 1¾ and 2¾ to 5 inches, inclusive	49½	68½	44½	65
2 to 2½ inches, inclusive	45	63	39½	59
6 inches and larger	57	62	52½	58

CASING.

	S. and S., per cent.
2 to 3 inches	58
3½ to 4 inches	63
4½ to 12½ inches	65

O. D. PIPE.

	Per cent.
14 to 22 inches	42
24 inches, o. d. and larger	37

THREADS AND COUPLINGS.

	Per cent.
14 to 16 inches, o. d.	35

MERCHANT STEEL.—At a meeting of the shafting manufacturers held last week the price of shafting was advanced 2 per cent, making carload lots 55 per cent off and less than carload lots 50 per cent off. The demand for this product is reported good. We make the following quotations: Tire steel in carload lots and over, 1.40c; less than carload lots, 1.45c to 1.50c. Toe calk is held at 1.50c to 1.55c in large lots, and in small lots as high as 1.60c. Tool steel is held at 7c and upwards according to quality. Hoops and bands, 2c to 2.10c.

OLD MATERIAL.—Before the end of the week the Pennsylvania railroad company will dispose of a large lot of old material and several other roads have specifications out for bids to be opened within the next ten days. Demand is only fair, although

dealers are realizing good figures when compared with the ruling prices of new material. We revise our quotations as follows: No. 1 railroad wrought, $18; car wheels, $18; new Bessemer melting stock, $14; iron rails, $20 to $21; steel rails, mill lengths, $14.50; busheling scrap, $14.50; borings, $6.75, turnings, $9.

WIRE AND WIRE NAILS.—Demand for these products is only fair, but there is every indication that there will be an immense spring trade as inquiries in large numbers are already being received. Prices are unchanged as follows: Single carloads of wire nails to jobbers, $2.20, Pittsburg; to retailers, $2.30. Plain wire, carload lots, is quoted at $2.15 to jobbers, and $2.25 to retailers; painted barb wire, $2.50 in carload lots to jobbers and $2.60 to retailers; galvanized barb wire, $2.80 in carload lots to jobbers and $2.90 to retailers. Cut nails are held at $1.95, Pittsburg, in carload lots with 2 per cent off in 10 days.

COKE.—During the past week a large number of furnacemen closed contracts for the first half, but a number are still holding off. The largest producer is holding his product at $1.75 per ton for furnace and $2.25 per ton for foundry coke. Contracts are being made by other Connellsville producers below these figures, however. Producers outside of the Connellsville region are selling their furnace coke at $1.50 per ton and sales of foundry coke have been reported below $2. For the week ending Saturday, Dec. 29, the total production of the Connellsville region as computed by the Connellsville *Courier* amounted to 185,720 tons an increase over the production of the previous week of 4,595 tons. Shipments for the week aggregated 8,494 cars, distributed as follows: To Pittsburg and river tipples, 2,970 cars; to points west of Pittsburg, 3,754 cars; to points east of Connellsville, 1,770 cars. This was a decrease of 643 cars compared with the shipments of the previous week.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1522 MONADNOCK BLOCK, Jan. 8

The first week of the new year has been a quiet one in this market. No very large business has been closed, with the exception of one or two good contracts for steel, but there is a fair demand for small lots, and prospects are excellent for a heavy business in the first half of the coming year. Makers of iron and steel generally are very well satisfied with the way the year opens, and express the belief that it will show a much larger tonnage of business than any previous year, and at prices that will insure a fair profit to the mills and furnaces. It is not expected that values will increase to any great extent over the present levels, and except in one or two lines no great increase is wanted.

PIG IRON.—The situation is practically unchanged from a week ago. Sales have been only for small lots, and have not been especially frequent. The demand for the immediate future shows some slight improvement over the past few weeks, but does not include any large inquiries. The furnaces are all well sold ahead, however, and are not pushing for business at all; the local furnaces have their order books well filled for the next five months at least. Buyers are paying the quoted prices for what they want with very little demurrer, and as the furnaces are all very firm in their views, the market is strong. While there is no immediate prospect of any advance, there is little danger that prices will recede. Quotations are unchanged as follows:

Lake Sup. Charcoal	$18 50 to $19 50	Southern Coke No. 4	$13 60 to $14 10
Local Coke Fdy. No. 1	15 75 to 16 00	Southern No 1 Soft	15 10 to 15 60
Local Coke Fdy. No. 2	14 75 to 15 00	Southern No 2 Soft	14 60 to 15 10
Local Coke Fdy. No 3	14 25 to 14 50	Southern Silveries	16 25 to 16 75
Local Scotch Fdy. No.1	15 75 to 16 00	Jackson Co. Silveries	18 50 to 20 00
Local Scotch Fdy. No.2	14 75 to 15 00	Ohio Strong Softeners	16 80 to 17 30
Local Scotch Fdy No.3	14 25 to 14 50	Alabama Car Wheel	21 75 to 22 75
Southern Coke No. 1	15 10 to 15 60	Malleable Bessemer	15 00 to 15 50
Southern Coke No. 2	14 60 to 15 10	Coke Bessemer	15 00 to 15 50
Southern Coke No. 3	14 10 to 14 60		

BARS.—The demand is large, and several very good contracts were taken in the past week. Most of the business went to the iron mills, the steel bar makers having their order books filled so far ahead that they cannot make required deliveries. Some of the steel mills are practically out of the market for the next several months. The Illinois Steel Co. contemplates building a continuous bar mill for making open hearth steel bars, either at Joliet, Milwaukee or South Chicago. The location has not yet been definitely decided. Prices are unchanged and are very firm at 1.45c to 1.50c, half extras, Chicago, for both iron and steel. Some of the large buyers in this territory have exceeded their contracts already, and will undoubtedly have to make additional purchases of bars for their present season's requirements within the next few weeks. The mills are all being rushed with specifications, and find it difficult to keep up with the needs of the consumers.

STRUCTURAL MATERIAL.—One large contract, that for the Marshal Field building, was placed last week, going to a Pittsburg contractor, and the steel to be made in that city. Otherwise the market was quiet, with no very important orders closed or in sight for the immediate future. The erection of a beam mill at the South works of the Illinois Steel Co. in the near future will mean an expenditure of about $2,000,000. Definite plans have not yet been given out by the company. Quotations are unchanged as follows: Beams 15 inches and under, 1.65c; 18 inches and over, 1.75c; angles under three inches, 1.40c to 1.45c; over six inches, 1.65c; three inches to six inches, 1.55c; plates, 1.55c; tees, 1.70c; zees, 1.65c; small lots from store are quoted ¼c to ½c higher.

RAILS AND TRACK SUPPLIES.—Sales of rails in the past week aggregate about 50,000 tons by the local mills. This includes one contract of 36,000 tons. Other good business is in sight and will be placed soon. Track supplies and light rails are selling well, with an average business for the week just closed. Quotations are as follows: Rails, standard sections, $26; light sections, $26 to $28; splice bars, 1.40c to 1.50c; spikes, 1.70c to 1.75c; track bolts, hexagon nuts, 2.55c to 2.60c; square nuts, 2.40c to 2.50c.

PLATES.—The demand is good, better in fact than the mills can take care of, as they are all well sold ahead. No important sales were closed in the week. The report of an advance in prices to take effect Feb. 1 is not confirmed by the mills. The market is very firm however. Prices are made as follows, mill shipment, Chicago delivery: Tank steel, 1.55c; flange steel, 1.65c; marine steel, 1.75c; fire-box steel, ordinary, 1.75c; fire-box, special, 2.25c and upwards.

BILLETS AND RODS.—No sales of either billets or rods were made last week. Billets remain unchanged at $20.75, Chicago, and the report that an advance will be made to take effect Feb. 1, is not confirmed by the mills.

SHEETS.—There continues to be a large demand for both black and galvanized sheets, and the sales of the week were excellent, including several important orders. Quotations are very firm and unchanged at 3.18c for No. 27 black, and 70 and 10 per cent off for galvanized, mill shipment.

MERCHANT PIPE.—The demand continues good, mostly for small lots, but one or two good contracts were placed last week. Random lengths are quoted as follows, Chicago delivery:

MERCHANT PIPE.

	Carload lots. Black Per cent.	Carload lots. Galv. Per cent.	Less than carload lots Black Per cent.	Less than carload lots Galv. Per cent.
⅛ to ½ and 11 to 12 in	59.3	46.3	54.9	40.9
¾ to 10 inches	66.7	53.3	61.9	49.9

WIRE AND WIRE NAILS.—Considerable business for nails and other wire products was placed last week, and the demand shows no signs of falling off. On the contrary it is exceedingly active. Makers quote single carloads of wire nails at $2.48 f. o. b. Chicago, and $2.63 for less than carloads. On wire, current quotations are as follows: Plain annealed wire, $2.43; painted barb wire, $2.78; galvanized barb wire, $3.08.

OLD MATERIAL.—Business has been quiet and limited to a few small sales. The demand is not large, and while the dealers are very firm in their views and are making no concessions, buyers are looking for somewhat lower prices, and do not seem to take hold of the market easily. Dealers' selling prices, per gross ton, are as follows:

Old iron rails	$18 50 to $19 00	Country malleable	$11 00 to $12 00
Old steel rails, long	15 00 to 16 00	Iron axles	30 50 to 31 00
Old steel rails, mixed	11 00 to 12 00	Cast borings	4 50 to 5 00
Relaying rails	20 00 to 22 00	Wrought turnings	8 00 to 9 00
Old wheels	15 00 to 16 00	Iron axle turnings	9 50 to 10 00
Railroad forge	16 50 to 17 00	Steel axle turnings	8 50 to 9 00
Dealer's forge	14 50 to 15 00	Mixed country steel	9 50 to 10 00
No. 1 cut mill	11 00 to 12 00	Stove plates	8 50 to 9 00
Heavy cast	13 00 to 14 00	Heavy melting steel	10 50 to 11 00
Railway malleable	13 00 to 14 00	Old iron splice bars	18 50 to 19 50

CAR MATERIAL.—There is a very large demand for all kinds of material entering into car construction, and the mills are all full of orders for some months to come. One of the mills placed some business outside last week, being unable to take care of it itself.

MERCHANT STEEL.—Sales have not been large, and as the demand is not especially active, they are not expected to improve for a few weeks to come. The mills are well filled with

orders for some time ahead. Quotations are as follows, mill shipments, Chicago delivery: Smooth-finished tire steel, 1.75c to 1.85c; open-hearth spring steel, 2.15c to 2.35c; toe calk, 2.40c to 2.55c; sleigh shoe, 1.70c to 1.80c; cutter shoe, 2.40c to 2.55c; ordinary tool steel, 6c to 7c; specials, 13c and upwards.

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
CAXTON BUILDING, Jan. 9.

Information from without the immediate center of interest in iron ore matters has pointed all along to January as the month that would develop the situation. But Cleveland sentiment, it would appear, is slow to crystallize. Iron ore men here seem least of all disposed to have "views" on the question of prices for 1901; the disposition is rather to let the conditions in the general iron market point the way. It is argued that though the price for 1900 turned out to be too high, it was not out of line when it was made, and under the like conditions in the finished material market would be repeated. There is a general disposition to take such action this year as will be regarded as fair by those consumers of ore who have little or no ore supplies of their own. It is felt that old range Bessemers, with nothing but supply and demand governing, will bring a good price, and in some quarters there is not the same anxiety about an agreement as in some other years. One producer of Bessemer and non-Bessemer ores was on the outside last year, and though its production of Bessemer ores was not large and its price was probably but a few cents below the agreed basis, any concession would be sufficient under such circumstances to enable the one outside interest to dispose of its entire product, while others in a year like 1900 would have ore to carry over. But whatever the outcome as to old range ores it is perfectly well understood that the Mesabi situation will be a free-for-all, with the prospect of even a greater disparity in price between old range and new range ores than heretofore. While the Mesabi produced about 42 per cent of the total last year, it is in position to put out much nearer one-half the Lake Superior production in the year just ahead, and it goes without saying that there will be something of a scramble to place it all. Thus far no interest is taken in the ore question by consumers; at least none of them are making inquiries about prices. The vessel situation, likewise, will not be hurried. Some feelers have been put out this week, but there is no real interest. It seems forgone that 50 cents will come off the Duluth contract rate of last year; how much more, is the question that will be threshed out in the next two months.

PIG IRON.—Gradually the number of active furnaces in the valley increases, but not because of any demand for Bessemer iron from steel works. The call for malleable and low phosphorus Bessemer, basic and forge irons takes up a certain amount of furnace capacity in addition to the regular consumption of foundry iron, which of late has been growing somewhat in this district. The foundries are gradually increasing their melt and there is good promise for the new year with most of them. Consumers of pig iron hereabouts have not covered beyond the first quarter as a rule, believing that prices will not advance and that they may get a slight reduction on later purchases in view of the reduction on coke and that expected on ore. Furnacemen on the other hand look for such reductions as they are realizing or are yet to receive on raw materials to compensate them for some of the profitless business of the second half of 1900. There has been no change in quotations the past week. New business has scarcely got a start, but a fair amount of January buying is looked for. The $13.50 basis for No. 2 foundry at valley furnace is maintained as a rule, though $13.25 is reported still possible. We quote as follows:

Bessemer	$14 00 to $14 25	Valley Scotch No. 1	$14 75 to $15 00
No. 1 Strong F'dry	14 75 to 15 00	Valley Scotch No. 2	14 25 to 14 50
No. 1 Strong F'dry	14 00 to 14 50	Gray forge, valley	12 50 to 12 75
No. 3 Foundry	13 50 to 14 00	Lake Superior charcl	18 00 to 18 50

FINISHED MATERIAL.—New business is light and sellers seem to have no great expectations for the opening month. The buying in the last five months of 1900 filled up a good many consumers for practically the first half on some lines, and it is more than possible that some of it was precautionary. Specifications are coming in steadily and in a way indicating heavy and well distributed consumption. The promise for spring building in Cleveland is excellent. Three important projects now in the architects' hands, involve 3,500 tons of steel, but only one is a certainty at date. In the past week beet sugar works contracts taken by a local concern have called for 2,000 tons of shapes. More rail buying is reported; one lot of 4,000 tons has been closed and another of 5,000 tons is pending. A sale of 500 tons of axle billets has been made and mills have been asked to bid on special stock for rivets that will be used on the battleships now under construction, several local concerns having figured on the contract, which involves 2,000 tons of rivets. Bar mills continue to run full without catching up very rapidly on their orders. Some of them cannot entertain business for delivery in the next month or two and these are quoting 1.35c at mill. Valley mills still quote 1.25c on steel and 1.25c to 1.30c on iron. From store Cleveland bar iron is sold at 1.5c. Sheet mills continue to have a good business, inquiry from roofing manufacturers being added to other considerable business that has come up recently. Prices are firm, the leading interest and the independent mills quoting 3c as a rule on No. 28, one pass through cold rolls. There is no change in the price of plates from 1.40c Pittsburg for tank. Little new business is offered and few mills are in a position to consider that little.

OLD MATERIAL.—The market is quiet, but neither mills nor foundries are carrying any considerable stocks and further buying is looked for in the near future. We quote the Cleveland market, all gross tons: Old iron rails, $18.50; old steel rails, long lengths, $13.50; 6 ft. and under, $11.50; old car wheels, $15; No. 1 railroad wrought, $16; mill scrap, $13 to $13.50; iron axles, $21.50 to $22; wrought turnings, $9 to $9.50; cast borings, $5.50; steel boiler plates, $10.50; grate bars $8; malleable iron, $11.50; stove plate, $7.50.

PHILADELPHIA.

Jan. 7.

The volume of new business has been small as yet this year, though active buying is expected to begin about the middle of the month. A number of inquirers have been heard, but buyers generally are waiting in hopes of lower prices, proportional to the expected decrease in cost of production. Sellers are firm and make but few concessions. The situation resolves itself into a contest between buyers and sellers, with odds favoring the latter, as deliveries are urgently requested. One large concern in the Philadelphia district has ordered a 10 per cent reduction in all departments owing to the low prices received for its products. Rumors are current that rails are to be advanced shortly $2 per ton. Billets are quiet, though sales reaching perhaps as high as 5,000 tons have been made. An advance is looked for, notwithstanding that at the recent New York meeting the pool price was reaffirmed.

PIG IRON.—Several inquiries for 5,000, 10,000 and 15,000 ton lots have been made, but the situation has not materially changed. Buyers claim that concessions have been made recently, but it is claimed that these are only on odd lots, and on other than standard brands. A number of sellers have refused offers made, preferring to wait for higher prices before closing. Some forge irons on which $14.75 was asked some weeks ago, have sold for $14. No concessions have been granted on No. 2 plain and No. 2 X foundry. The expectations of a larger supply seems about to be met. Prices for Philadelphia and nearby delivery are as follows: No. 1 X foundry, $16.25 to $16.50; No. 2 X foundry, $15.50 to $16; No. 2 plain, $15 to $15.25; gray forge, standard brand, $13.75 to $14.25.

FINISHED MATERIAL.—The market is very firm, with a tendency to advancing prices. Sheets have already advanced $1 to $2 per ton and the demand is increasing. Plates are strong. Ship builders and bridge builders are in the market for large lots and several contracts of 1,000 to 4,000 tons have been made. Quotations are as follows: Best refined iron bars, 1.45c to 1.50c; steel bars, 1.40c to 1.45c; plates, ¼ inch thick and thicker, 1.55c to 1.60c; beams and channels, 1.65c to 1.75c; sheets, Nos. 10-12, 1.80c to 2c; No. 14, 2.05c to 2.15c; No. 16, 2.20c; No. 20, 2.60c to 2.70c; No. 24, 2.90c; No. 27, 3.10c; No. 28, 3.20c.

OLD MATERIAL.—Active buying is looked for in the near future. Buyers and sellers are not together yet on prices. We quote: Choice railroad scrap, $17.50 to $18; No. 1 yard scrap, ordinary, $14 to $14.50; No. 2 light scrap, $12 to $12.50; machinery cast, $14 to $14.50; heavy steel scrap, $15 to $15.50; old

iron rails, $17.50 to $18; old steel rails, $15.75 to $16.25; wrought turnings, $10 to $11; cast borings, $8 to $8.25; old car wheels, $17.50 to $18.

BIRMINGHAM, ALA.

Jan. 7.

The iron market has been quiet the past week with unchanged prices. Local quotations based on No. 2 foundry at $11.25. Iron manufacturers attribute the dullness in the market at present to the annual stock taking now being made by the consumers throughout the country and which, they say, occurs at the beginning of each year. President Hopkins, of the Sloss-Sheffield Steel & Iron Co., states that he expects renewed activity in the demand by the latter part of this month and that he believes when it does set in again it will continue through the year. Mr. Hopkins states that the four furnaces in Birmingham and one at Florence, Ala., of his company are now in blast and that the two at Sheffield will be blown in within five or six weeks. He says it is the intention of his company to continue in operation every one of its seven furnaces.

Eugene Zimmerman, of Cincinnati, owner of pig iron furnaces at Talladega, Ala., and Cedartown, Ga., who was in Birmingham Saturday, stated that the Talladega furnace would be put in blast within four or five weeks. The furnace at Cedartown is now in operation. Mr. Zimmerman recently sold the Decatur furnace to the Tutwiler Coal, Coke & Iron Co., of this city. The latter company will remove the furnace to Birmingham at an early date.

The rolling mills in this city are now running about half time, but will probably be put on full time before spring. They still have large stocks of finished products on hand which they will dispose of before operating the mills to their full capacity again.

The Alabama Metal Roofing Co. is building a corrugated roofing plant in this city with a daily melting capacity of twenty tons. It will be in operation within two or three weeks.

On account of the recent advance in the price of iron the coal miners in the Birmingham district will receive the maximum wages dating from January 1. The maximum price called for in the present contract between the operators and the miners is 55 cents a ton. Since September 1 they have been receiving 52½ cents a ton.

The local foundries report business good at present. They have all the orders they can fill and the outlook for the spring and summer business is brighter than a year ago.

PERSONAL.

E. F. Bradt, recently agent or the Manila Iron Co., has accepted a position with the American Mining Co., the iron mining interest of the American Steel & Wire Co. He will have charge of the explorations on extensive territory on the new Atikokan range in Canada.

S. H. Stupakoff has resigned as general superintendent of the Pennsylvania Malleable Co., McKees Rocks, Pa., to devote himself to the manufacture of molding machines and other specialties of his own invention.

It is reported that Andrew Carnegie will give $200,000 for the erection of a library in Seattle, Wash.

C. B. Houston of Chester, Pa., has been elected to succeed George H. Stickney, of Philadelphia, as president of the Tidewater Steel Co.

Ernest Vaughn, of Youngstown, O., has been appointed superintendent of the Girard, O., plant of the American Steel Hoop Co.

Charles F. McDonald, superintendent of the converting department of the Duquesne plant of the Carnegie Steel Co. will be the next official to be given a trip to Europe at the expense of the company. He will leave in April and will remain away about three months.

Edward J. Hamilton of Braddock, Pa., has been appointed assistant to Joseph Schwab, superintendent of the Duquesne steel plant of the Carnegie Steel Co. He will fill the vacancy caused by the resignation of William Richards, who has entered the services of the Dominion Iron & Steel Co. of Sydney, Nova Scotia.

George D. Wick, president of the Youngstown Iron, Sheet & Tube Co., and S. V. Huber, the engineer for the company, left for England last week on business.

The Illinois Steel Co. announces the following changes in its force: T. J. Hyman, treasurer, to succeed William H. Thompson, resigned; James P. Walker, assistant secretary, to have charge of accounts and claims; A. J. Singer, manager of credits and collections; A. W. Carlisle, cashier.

CARNEGIE COMPANY DINNER.

The first dinner of the Carnegie Co. and officials and representatives of subsidiary companies was held at the Hotel Schenley, Pittsburg, Wednesday evening, Jan. 9. Covers were laid for 91 guests and the tables were arranged in the form of a cross section of a steel rail, this and other features being decidedly unique. Before the toasts the following letter of regret from Mr. Carnegie was read by Judge Reed, the toastmaster:

My Dear Chairman Taylor:—I have delayed answering your kind invitation, hoping that I might see my way clear for three days' absence in order to accept, but I regret to say it seems impracticable to get these indispensable days just at the date necessary and I am compelled to forego the pleasure of attending the first dinner of the officials of the Carnegie Company. I did wish to be present, believing in these social gatherings because it is largely in vain that colleagues labor who are not friends. Much of the success of the Carnegie firm has come from the fact that we were always partners and friends. My recent visit to Pittsburg satisfied me that you were more closely knit together than for many years past. I enjoyed myself among you all to an unusual extent, feeling that mutual confidence and friendliness were the elements of the air you breathed. Also I noted you were one and all resolved that the Carnegie Company should hold the position of pre-eminence it had through your efforts acquired. From what I know of its future plans and of the ability and enthusiasm of its officials and its men, I venture to predict that its future is to eclipse its past.

To one and all I feel like an elder brother, liking you all and recognized as one of you in return. With every good wish for every one,

Always your friend and colleague,
ANDREW CARNEGIE.

The following toasts were responded to: "Magnetic Influences," Dr. N. P. Hulst; "Disposition," J. Ogden Hoffman; "Transit," Francis E. House; "Security," Lawrence C. Phipps; "Concentrated Sunbeams," Thomas Lynch; "Musings," William B. Dickson; "Expectations," Charles M. Schwab. Letters of regret were received from Henry Phipps, Col. Millard Hunsicker, European representative; William B. Isaacs, Pacific slope representative, Lieut. C. A. Stone, Washington representative; Edward M. Sparhawk, Denver representative, and Samuel A. Benner, South American representative.

The following were present: J. W. Anawalt, Chas. W. Baker, W. R. Balsinger, Sam'l A. Benner, P. T. Berg, L. C. Bihler, W. W. Blackburn, H. P. Bope, M. M. Bosworth, G. B. Bosworth, L. T. Brown, N. D. Carpenter, J. J. Campbell, Charles Cassils, A. C. Case, D. M. Clemson, W. H. Clingerman, W. R. Conrad, Thos. F. Cole, W. E. Corey, G. G. Crawford, D. N. Coble, W. B. Dickson, Chas. E. Dinkey, A. C. Dinkey, A. H. Eames, W. A. Fennerty, P. J. Flickinger, Jno. C. Fleming, R. A. Franks, C. D. Fraser, W. N. Frew, James A. Gayley, E. B. Gilbert, G. K. Hamfeldt, E. H. Hamilton, J. B. Hardie, J. Ogden Hoffman, F. E. House, Nelson P. Hulst, James Hunter, W. H. Jeffries, Norwood Johnson, Geo. W. Johnson, G. R. Johnson, Philip Keller, Jr., Walter M. Kelly, F. A. Kelly, O. W. Kennedy, D. G. Kerr, J. P. Kessler, Jr., P. C. Knox, George Lauder, Homer J. Lindsay, Wilbur Sargent Locke, Thomas Lynch, W. C. Magee, J. S. Matson, J. P. Miller, Edwin S. Mills, A. Monnell, Thos. Morrison, Geo. E. McCague, W. C. McCausland, George A. McDougal, F. R. McPeatters, John McLeod, C. H. McSwigan, John C. Neale, Henry W. Oliver, George T. Oliver, Gibson D. Packer, A. R. Peacock, Lawrence C. Phipps, H. T. Porter, W. J. Post, J. H. Reed, Robert R. Richardson, J. M. Ritchie, Charles M. Schwab, J. E. Schwab, S. L. Schoonmaker, James Scott, Wm. H. Singer, Wm. H. Smith, T. Guilford Smith, C. H. Spencer, Chas. L. Taylor, W. J. Totten, W. H. D. Totten, Jr., E. H. Utley, J. E. Woods, E. F. Wood.

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AND
INDUSTRIAL WORLD.

DEVOTED TO MACHINERY METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

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BRITISH IRON PRODUCTION DECLINING.

While the output of pig iron in the United States in 1900 will probably prove to be 100,000 to 150,000 tons in excess of the record of 13,620,703 tons in 1899, it is estimated that in Great Britain the production was from 200,000 to 300,000 less than in the preceding year. The two countries enter upon 1901 with opposite tendencies—in Great Britain a curtailment of output, a number of blast furnaces having gone out of blast in the past few weeks, while in the United States the output of pig iron is on the increase. In giving this estimate of the year's outcome in pig iron the London *Iron and Coal Trades Review* notes that the volume of business in iron and steel is being rapidly contracted there and that the outlook is much less favorable than at the same period one year previous. British iron and steel exports in November were 83,000 tons less than in November, 1899, and for the 11 months ending with November were 3,336,200 tons, against 3,399,522 tons in 11 months in 1899, a falling off of 63,322 tons. The imports show a corresponding increase, being 666,941 tons to November 30, in 1900, as against 604,671 tons in the 11 months of 1899.

The English press takes rather a gloomy view of the outlook; but as we have pointed out before, some of the pessimism is due to looking too intently on current receipts from the United States, which are far larger than current sales for export from this country. The promise for export trade of American steel producers is far from being what they would have it for 1900. Low prices abroad and high ocean freights are cutting off this business sharply. The London *Iron and Coal Trades Review* points out that the situation is not as hopless for the British iron manufacturer as some are inclined to believe. It concedes that there are more plants in the United States that can produce pig iron and steel at low figures—say $7.50 for pig iron and $12 for steel—than in the iron-making districts of England but it cites an English works at which pig iron is made at 28 shillings, and adds that the number of such works may be increased when furnace gases and coke oven by-products are fully utilized. Undoubtedly the progress of the United States in foreign markets is impeded most by lack of ocean vessels adapted to the carrying of bulk freight; and on the working out of that problem depends the success of the campaign for world markets on which so good a beginning has been made.

THE Kennedy-Morrison improvement in rail mall practice, recently described in these columns, is favorably commented upon by the Railroad Gazette, which has given no little attention in the past few years to the complaints of the wearing qualities of heavy section rails. Referring to the temperature at which the rails will pass the finishing rolls, after having gone from the intermediate rolls to the special cooling bed, the Railroad Gazette is informed that it will probably be in the neighborhood of 1400 degrees. The same authority states that the management at the Edgar Thomson mill is experimenting with an optical apparatus for determining the temperature, with a view to its use by an inspector or operator in the mills. Of the process and the results achieved it adds: "It seems to us that this is one of the most important improvements in rail making that has appeared in recent years, and we should expect great results from it. Obviously if it is successful, all of the rail makers will have to use it."

Lake Superior Iron Mines.

The Chapin Mining Co. is installing two pumps in B shaft. The larger is a triple expansion pump, with capacity of 1,200 gallons per minute, and the smaller a direct-acting triple expansion pump. These will give the company one of the largest and most perfect pumping plants in the Lake Superior iron region. The pumps are being furnished by the Fred M. Prescott Steam Pump Co., of Milwaukee.

It is reported that the Oliver Iron Mining Co. has under consideration the building of a railroad from its mines at Ironwood and Bessemer to a point on Lake Superior, distant from Ironwood only 14 miles. It is said that the company has purchased a large water frontage for docks and has secured the right of way for the tracks. If a new port were established it would divert about 2,000,000 tons of ore annually from Ashland.

It is said that the Northwestern Iron Co., Mayville, Wis., is negotiating for a lease of the Lucy mine at Negaunee, Mich., and plans to pump out and equip it. The royalty stipulated is 7 cents per ton, up to 60,000 tons, and after that on a sliding scale that will average somewhat more, with the privilege of purchasing the fee at any time.

Officials of the Oliver Iron Mining Co. have contributed $500 toward establishing manual training in the schools at Negaunee, Mich.

At the meeting of the executive committee of the Tennessee Coal, Iron and Railroad Co., held in New York on Monday, Jan. 7, the committee unanimously approved the selection of President D. H. Bacon, of the Minnesota Iron Co., as chairman of the board of directors of the Tennessee Company. As noted elsewhere in this issue in connection with his portrait, Mr. Bacon is succeeded as president of the Minnesota Iron Co. by J. L. Greatsinger, who is also president of the Duluth & Iron Range Railroad. C. P. Coffin, formerly secretary of the Minnesota Iron Co., has been elected vice president, and L. T. Beecher has been made secretary.

Calendars.—Attractive calendars have been received from the following concerns: Kier Bros., Pittsburg, manufacturers of Salina fire brick; Henderson & Trago, 1431 Williamson Bldg., Cleveland, commission merchants and brokers in pig iron and coke; the Van Dorn & Dutton Co., Cleveland, general machinists and engineers; J. R. Vandyck, New York City, dealer in general machinery supplies; the Chicago Pneumatic Tool Co., Chicago, manufacturers of pneumatic tools and appliances; The Lunkenheimer Co., Cincinnati, O., manufacturer of lubricators, etc., calls attention to its specialties by means of a large pad calendar. It is designed for the wall rather than the desk. Features of the calendar are the large size of the date numbers, the current month's entire notation on each leaf, in addition to the separate day, and the absence of separate leaves for Sundays throughout the year.

GREAT CARNEGIE TUBE WORKS AT CONNEAUT.

In explanation of the extensive land purchases of the Carnegie company at Conneaut Harbor, Ohio and the numerous reports of the company's intention to establish a manufacturing plant at that point, President Charles M. Schwab announced this week the plans of the company with respect to these purchases. He states that for over a year the Carnegie Co. has contemplated entering into lines of manufacture other than those in which it has been engaged hitherto; and the first step in carrying out this purpose is to be taken at once by the establishment of the largest pipe and tube manufacturing plant in the world at Conneaut Harbor, which is the Lake Erie terminal of the Carnegie-Pittsburg, Bessemer & Lake Erie railroad, 153 miles from Pittsburg.

The company has purchased 5,000 acres of land immediately east of the Conneaut harbor docks and a large part of this tract will be utilized as a site for the tube works. It was the intention before the plans were begun, a year ago, to locate the works upon the Monongahela river, but the enormous area of the proposed establishment made such a site impracticable. Options upon land on the Allegheny valley railroad at Tarentum, Pa., were then secured with the view of locating the works there. However, investigation proved that the drawbacks of this site were too numerous and difficult to overcome. The Tarentum land required a railroad to be built in order to connect with the Bessemer railroad, and to do this it was found that it would be necessary to move the tracks of the Allegheny Valley road. The site is also comparatively small for the purpose intended and left no ground for future additions.

With the works established at Conneaut it is the expectation to rush the shipments during the months of navigation—April to December—and thus reduce transportation charges to one-third of the rates now charged for rail shipment. The Bessemer railroad at present returns hundreds of empty cars daily to Conneaut and with the works on the lake shore completed, the road will have a back haul of coal and coke, the transportation of which will cost virtually nothing. It was desirable to utilize the full benefits of the Bessemer railroad and the shipment of coal and coke will balance the traffic to some extent. From Conneaut water communication is had to New York, Boston, and other eastern ports, via the Erie Canal and the Welland Canal; also to the large cities on the lakes, including Chicago, Milwaukee, Cleveland and Buffalo.

Lake Erie will furnish an abundant water supply for the tube works a very important consideration in locating a plant of the size proposed. The works will stretch over a mile of the lake front and will be the most extensive and complete plant of its kind ever built. It will include all essentials in pipe and tube manufacturing, from the ore to the finished product. The general system of operation will be continuous; the ore being unloaded from vessels at one end and worked through the successive stages of iron and steel making in a direct line to the finished pipe and tubing at the other end. Electric power will be principally employed for driving the machinery. The blast furnaces to be built will probably exceed in size and capacity the two great stacks now being finished by the Carnegie Steel Co. at Rankin. The investment exclusive of ground will reach about $12,000,000. Work will begin at an early date, but the plant will not be completed until 1902 is well along.

The sale of the plant of the Champion Iron & Steel Co. to the American Tin Plate Co. was announced last week. The Champion Iron & Steel Co. was incorporated two years ago by Chicago people to acquire and operate a rolling mill at Muskegon, Mich. The owners of the company included R. L. Henry, D. B. Scully and Walter E. Stoy, who were president, general manager and secretary, respectively. It has been the only Western plant in opposition to the American Tin Plate Co., and one of the most important. With this purchase the American Tin Plate Co. will practically control the entire market, for a time at least. The Champion company had at its plant tin mills, plate and sheet mills, an open hearth steel plant and a bar mill. Recently only the sheet and tin plate mills have been in operation.

Reports state that the Whitman & Barnes Mfg. Co., Akron, O., are contemplating moving their drill works to West Pullman, near Chicago.

THE FOUNDRYMEN'S ASSOCIATION.

The regular monthly meeting of the Foundrymen's Association was held at the Manufacturers' Club in Philadelphia on Wednesday, January 2. The vice president, James S. Stirling, occupied the chair. The following were in attendance:

Jas. S. Stirling, Harlan & Hollingsworth, Wilmington, Del.; W. H. Echternach, Girard College; G. T. Johnson, Howe, Johnson & Co.; J. S. Keightley and E. Zwick, Geo. V. Cresson Co.; W. E. Arnold, L. & R. Wister & Co.; A. W. Griffith and Geo. Rockett, Diamond State Steel Co., Wilmington, Del.; W. B. Hughes and S. H. Ralston, A. & P. Roberts Co., Pencoyd, Pa.; C. H. Haesler, Chicago Pneumatic Tool Co.; C. S. Matthews, Camden Iron Works; C. H. Newcomb, Matthew Addy & Co.; C. S. Koch, Wm. Sellers & Co.; W. P. Pressinger, New York Air Compressor Co., New York; Thos. Alcorn, Chicago Pneumatic Tool Co., New York; Geo. C. Davis, chemist; Theo. B. Rohrman; J. Hy. Pepper, *The Iron Trade Review;* Robt. W. Trump, Phila. Stove & Iron Foundry Co.; H. O. Evans; A. G. Warren, J. W. Paxson Co; N. W. Shed, Wm. Cramp Ship & Engine Building Co.; Wm. Hanson, Pennsylvania Iron Works Co.; I. R. Newkirk, J. B. Newkirk & Co.; W. S. Hallowell, Harrison Safety Boiler Works; W. H. Ridgway, C. Ridgway & Son, Coatesville, Pa.; T. B. Harkins, T. B. Harkins Foundry Co., Bristol, Pa.; J. A. Burr, Burr & Houston Co., Brooklyn, N. Y.; G. T. Mash, S. Baltimore Car Works, Baltimore; A. C. Pessano, Geo. V. Cresson Co.; E. E. Brown, E. E. Brown & Co.; Wm. D. Thomas, *The Iron Trade Review;* J. Mills, Jr., Abendroth Bros., Port Chester, N. Y.; J. M. Payne, Crocker Bros.; L. A. Hickley, Davis Coal & Coke Co.; Howard Evans, J. W. Paxson Co.

L. & R. Wister & Co., Philadelphia, were elected to membership in the association.

W. P. Pressinger, of the New York Air Compressor Co., New York, read a paper on "Pneumatic Tools and Appliances in Foundry Service." It will be found on another page.

In the discussion which followed a number of those present expressed their views on the utility of compressed air in the foundry.

H. O. Evans in the course of a few remarks covering his experience with compressed air, said: I have been connected with a number of foundries during the past few years, and I think the most useful part of the equipment has been that providing for the use of compressed air. Of plants in my charge there were none where I did not increase the capacity of the compressed air service. Its greatest charm is its perfect cleanliness. It provides for the cheapest hoisting apparatus that can be put in a foundry. Sometimes I have had as many as 20 or more pneumatic hoists in use on one installation. We found that compressed air hoists were well adapted for handling hot iron safely. I can quite agree with Mr. Pressinger when he says you cannot put too large a compressor into a plant nor have the piping too large. There are so many uses for compressed air besides the hoists. One thing sometimes lost sight of it its adaptability for cheaply whitewashing or painting the interiors of foundries and shops.

Secretary Evans: I would like to ask Mr. Pressinger how, in case he wanted to use pneumatic cranes and other equipment, he would arrange for the different pressures.

Mr. Pressinger: If you are going to use a very large volume of air for sand blasting it would be better to instal the lighter pressure. It can be readily shown that there would be a decided saving in the cost of a general installation to have a separate pressure for this work. For riveting you must have about 100 lbs. pressure. Compressed air in plants suffers somewhat from the fact that there is frequently an insufficient supply, and when many tools are run the pressure runs down. If you are going to realize all the advantages of the tools you must have plenty of compressed air. Even if a plant does cost a little more it is better to make a full provision at the start.

Secretary Evans: Instead of putting in a small compressor, in the case of a sand blast requiring, say, about 20 lbs. pressure, why not put in a high presssure so that you have the capacity?

Mr. Pressinger: In using only one or two chipping tools and a hoist or two it would not pay to have two compressors.

It would be better to have a compressor for 80 lbs. to 100 lbs. and reduce this pressure for the sand blast.

Secretary Evans: I know of a case where they run chipping tools, a sand blast, and an oil melting furnace and they use a reducing valve to reduce the pressure from 80 lbs. to 25 lbs. and it works very well.

Mr. Pressinger: Yes, it would work all right.

Secretary Evans: Would it work with economy?

Mr. Pressinger: Not if you have a large installation. It is hardly economy to compress to 80 lbs. when you only need 20 lbs.

Mr. Stirling: In your air hoists can you get the positive movment in the down or up stroke?

Mr. Pressinger: The hoist is supposed to do that, but we have yet to see the oil governed hoist that will do it absolutely.

H. O. Evans: I think I have a positive hoist. I have built a hoist and made it work all right. I get my pressure on top of the oil. When a positive action is desired the full pressure is thrown on and the air valve controlled. I put this hoist in for the express purpose of handling iron. I used to pour five pots to the ladle. I poured as fast as a 36-in. cupola could melt the iron.

Mr. Ridgway: We have just furnished to Wm. Sellers & Co. a direct acting air hoist, 50 tons capacity, a type which they are putting in cranes which they are furnishing to a prominent iron company. The fact that a concern like this would take hold of an air hoist to the capacity of 50 tons for handling great ingots of steel under a hammer where large numbers of men would be working would make you realize that it is possible to make an air hoist, governed by oil or water. We make large numbers of air hoists governed by oil, up to 5 and 10 tons' capacity all the time, and we have no trouble with them in thoroughly controlling their action. We are able now to supply any one with a perfectly controlled air hoist. There is a great demand, I think, for a first-class belt driven air compressor. We pipe our machines for both steam and air and in almost every foundry in which I have made installations I find they are going by steam entirely. In Fraser & Chalmer's new shop their equipment is composed of oil governed air hoists entirely.

Mr. Pressinger: I will say that the foundry trade has suffered a great deal through imperfect and insufficient air compressors, the installations being made on account of cheapness. I think, too, that foundrymen do not look after their compressors quite as well as other users. They should be kept clean and free from dust.

H. O. Evans: I have had perfect satisfaction with such compressors as I have used.

Mr. Stiring: We have compressed air which we use for various purposes, many outside of regular foundry work. We were probably among the first users of pneumatic rammers. We had one of the Cramp design, which is very good, but we found the vibration it caused was a little too much for our building. We have since used a portable kind which answers better.

Mr. Hallowell: In how small a foundry would it pay to install an air compressing plant? I should like an expression of opinion in regard to this. The size of the plant, I think, must have a good deal to do with the real value of the installation.

Mr. Pressinger: There is hardly a foundry too small to use compressed air to advantage. If one or two chipping hammers can be used with a hoist or two, compressed air would prove profitable. The makers of apparatus stand ready to install equipments subject to fulfillment of claims they make as to what they will accomplish.

Secretary Evans: What would be the cost of the smallest equipment?

Mr. Pressinger: About $250 I think would cover the cost of a small equipment. In a foundry in Brooklyn the proprietor became interested of his own accord in compressed air, and came to us to buy a compressor and appliances, and the foundry, I thought, was almost too small to recommend an outfit for. It was insisted on, however, and the installation was made and is to-day paying handsomely.

Secretary Evans: What does he use with it?

Mr. Pressinger: I think two chipping hammers and one or two hoists. He is well satisfied with his outlay.

Mr. Pessano: I can fully confirm what Mr. Pressinger said as to the advisability of any foundry requiring even two or three chipping tools and possibly an air drill or two putting in an equipment. We started ours with two chisels and a small compressor, and since then, inside of a little over a year we have put in possibly 12 or 14 more chisels and eight air hoists. We also do all our molding by compressed air, and the whole was the outcome of starting in a small way. I can also advise the installation of compressors of good size. I would like to ask Mr. Pressinger whether in his experience he has arrived at any established point as to the proper pressure for operating air chisel hoists, molding machines, and so on.

Mr. Pressinger: I should say 80 lbs. to 90 lbs. according to conditions. I would also point out the necessity for having absolutely air tight piping. The loss from waste is not always understood and is greater than steam, and it is not always discovered. Much power is wasted through leakage.

DEATH OF JOSEPH P. METCALF.

Joseph Prescott Metcalf, president of the Erie Malleable Iron Works of Erie, Pa., died in that city on Tuesday, Jan. 1, aged 53 years. He was one of the most prominent members of the business and social circles of Erie, which was his native city. With the exception of a few years' residence at Nebraska City, Neb., where he was cashier of a National bank, his life was spent in Erie. In the building up

JOSEPH P. METCALF.

of the industry with which he was connected he had shown good business ability, and was highly regarded both among home associates and those in the wider business circles included in national organizations to which he belonged, particularly the National Foundrymen's Association and the association of malleable cast iron manufacturers.

Absorption of Standard Seamless Tube Co.

The National Tube Co. came into control this week of the majority of the stocks of the Standard Seamless Tube Co., of Pittsburg, whose plant is located at Ellwood City, Pa., and reorganized the official force of the company by electing F. J. Hearne, first vice president of the National Tube Co., president of the Standard Seamless Tube Co., and W. H. Latshaw, third vice president of the National Tube Co., secretary and treasurer. The offices of the company have been removed from the Germania Bank Building in Pittsburg to the offices of the National Tube Co. in the Conestoga building. By the acquisition of this seamless tube plant the National Tube Co. becomes the largest producer of seamless tubing in the country, having control previously of the United States seamless tube plant at Christy Park, Pa. It is now in a position to produce seamless tubing of any size from one-half inch o. d. to 16-inch o. d., of any practical gauge. The Standard Seamless Tube Co. was organized a little more than a year ago and is capitalized at $500,000. Experts regard the plant as one of the best equipped in the country and the drawing processes are covered by patents owned by the company. The chief output thus far has been marine and locomotive boiler tubes, although bicycle tubing is also manufactured.

WALKER SMOKELESS FURNACE.

Robert L. Walker, Park Row Bldg., New York, has invented and patented a smokeless furnace, in which the gases are thrown down against the fuel bed by a deflecting arch. The accompanying illustration and description are from the *Engineering News*:

The construction of the furnace may be understood from Fig. 1. The forward part of the grate F. is stationary, and slopes towards the rear of the furnace. Back of it is a dumping grate D. The fresh fuel is fired upon the front part of the grate, the incandescent fuel being pushed back upon the dumping grate. Air is admitted through all parts of the grate and also from the conduit H. The air for this conduit may be brought up from the ashpit through passages in the

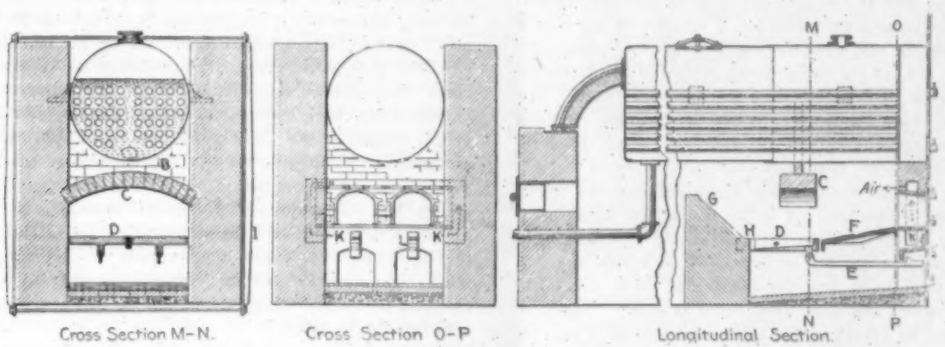

FIG. 1.—WALKER SMOKELESS BOILER FURNACE.

B. Wall above arch. C. Firebrick arch. D. Rocking or dumping grate. E. Connecting rod of grate. F. Common grate. G. Bridge wall. H. Sill level with grate. I. Brick stay. K. Air conduit. L. Angle iron.

side walls, and will then serve to preserve the latter from the destructive effects of heat. This air mingles with the smoke rising from the grate and the mixture is thrown down by a reverberatory action against the incandescent fuel bed at the rear of the furnace. This insures complete and smokeless combustion if properly fired.

The same principle may be applied to various other kinds of furnaces besides boiler furnaces. A puddling furnace is shown in Fig. 2. The supply of air over the fire should preferably be heated and it may be drawn from a regenerator or other device. Two furnaces of this type are in use in an eye-bar upsetting plant at the Carnegie Works at Pittsburg,

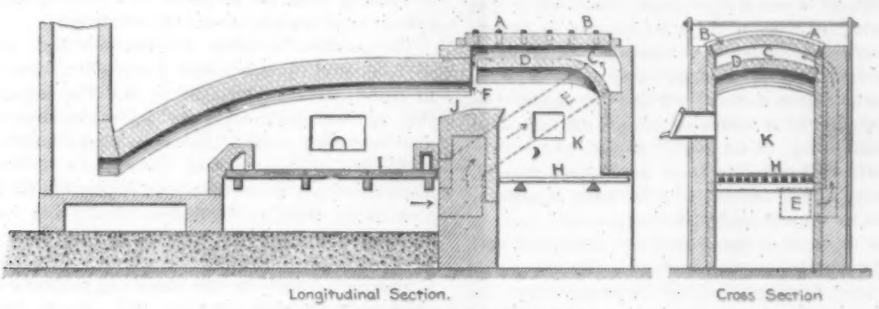

FIG. 2.—WALKER PUDDLING FURNACE.

A. Iron clamp. B. Arch over air-space. C. Air duct. D. Arch or roof of firepot. E. Air duct through side walls. F. Deflector. H. Grate bars. I. Hearth. J. Bridge wall. K. Firepot.

and they are said to show improved economy of coal over the furnaces which they replaced.

Efficiency tests have been made of a number of boiler plants equipped with the furnace above described, and the results are summarized below:

Results of Tests of Walker Furnace.

Tested at	Rockland Print Works.	Keystone Brewery.	Hollingsworth & Vose.
By	Walker.	Hyde.	Hyde.
Time	12 hours.	10 hours.	10.23 hours.
Type of boiler	Return tube.	Heine.	Return tube.
Dimensions	72"x18'	.....	.....
How fired	Hand.	Hand.	Hand.
Heating surface	1,860 sq. ft.	.....	.....
Heating sur. per H.P.	11.4	.....	.....
Grate surface	43 sq. ft.	42 sq. ft.	30 sq. ft.
Fuel	S. c. slack.	Run of mine.	Pocahontas.
Fuel per sq. ft. grate per hour	13 lbs.	22.8 lbs.	14.5 lbs.
Water evap. per. hr.	4,386 lbs.	8,538 lbs.	4,010 lbs.
Evaporation per lb. combustible*	11.16 lbs.	10.68 lbs.	11.62 lbs.
Steam pressure	53 lbs.	120 lbs.	128 lbs.
Temperature of feed	105°	170°	65°
Draft	0.5-in.	0.6-in.	.....
H. P. developed	146	268	140
Rated H. P.	124	250	.....
Temp. escaping gas	421°	583°	423°

*From and at 212°.

Referring to the results with his puddling or heating furnace the designer says: "The average puddling furnace delivers 0.87 lbs. of iron per lb. of Pittsburg coal used; whereas with the Walker furnace the average is 1½ lbs. of iron per lb. of coal. The two heating furnaces referred to at the Keystone Bridge Works previous to my changing them, turned out in 24 hours 44 eye-bars; this was the largest number they ever did. After the change as many as 119 were done in the same length of time with 50 per cent less coal. With the Walker continuous heating furnace at another plant the average output per week was 1,032,640 lbs., and the coal per ton of billets heated was 152 lbs. The furnace before changing burned 400 to 440 lbs. of coal per ton of steel billets, 4½x4½x54 ins., and turned out per week 674,244 lbs., according to the statement of the owner of the mill. Heating iron piles, the Walker furnace in one week's trial turned out 289,756 lbs., or 2.76 lbs. per lb. of coal. The same furnace before the change turned out 1.73 lbs. of iron per lb. of coal, thus showing 61 per cent saving in favor of the Walker furnace. At the same time, 90 per cent of the smoke was got rid of."

CONTRACTS for six large steel freighters instead of four were closed last week by the American Ship Building Co., bringing the total number of orders up to 32. The order from Mr. Frank H. Peavey, controlling grain elevators at Duluth, for four steamers was made public at once, but information regarding the other two vessels was withheld. One of them is for Senator McMillan, Mr. Alex. McVittie and others who own the steamer Senator. This vessel, an ore and grain carrier, will be a duplicate of the two larger vessels building for J. C. Gilchrist—about 5,000 gross tons capacity, with triple expansion engines. The other steamer is for the Western Transit Co. of Buffalo and will be a package freighter similar to the Starruca—345 ft. over all, 325 ft. keel, 44 ft. beam and 28 ft. deep. She will have quadruple expansion engines with cylinders of 19, 29½, 35 and 58 in., and 48-in. stroke. The capacity is to be 3,000 tons of package freight and the speed 13 miles.—[Marine Review.

The blast furnace of the National Steel Co., at Zanesville, O., was blown out last week.

PNEUMATIC TOOLS IN FOUNDRY SERVICE.*

BY W. P. PRESSINGER, NEW YORK

In discussing the employment of pneumatic tools and appliances in foundry work, it is not my purpose to describe any device not perhaps familiar to you all, but rather to present, in as brief and collective a form as the subject permits, the various appliances which have lightened labor and reduced costs in foundry service, that are dependent upon compressed air as their actuating medium. The introduction of pneumatic tools in a form marketably perfected for shop or foundry usage dates back but a few years, and their widespread adoption, remarkable for its rapidity, is, after all, the most convincing proof of their commercial value. To-day a boiler shop or machine shop devoid of compressed air equipment is a rarity, and if the foundry end of our mechanical community is not so well provided for, I venture to say that it is because the merits and labor-saving properties of pneumatic machinery have not, in the rapid development of the business, been as thoroughly demonstrated to the foundry trade. The day is near at hand, however, when a foundry without pneumatmatic equipment cannot produce its output in commercial competition with foundries that have adopted it.

The best known and most widely employed foundry appliance actuated by compressed air is the pneumatic hoist, originally used only in the straight lift, piston and cylinder form, but now utilized in a variety of types. Two forms are employed, the vertical hoist and the horizontal style, the latter being desirable when available head room is scant. The horizontal hoist may be arranged for a lift of 2 feet or 4 feet for each foot of piston travel, when desired. Operated by a simple three-way valve, with no complicated mechanism, these hoists are well nigh indispensable for duty not requiring an immovably sustained load. For this latter demand, where irregular action is not permissible, a more refined type of hoist is obtainable in which the incompressible qualities of oil are used to govern and restrain the sometimes too elastic properties of compressed air. This is accomplished by providing the hoist with a hollow piston rod filled with oil, thereby preventing a more rapid movement of the piston in its upward travel, than emission of the oil through the necessary controlling valve will permit. This form of hoist eliminates that element of danger which otherwise would be present in handling vessels of molten metal, and also permits a sort of elastic positiveness which is so essentially desirable. In the actual work of molding, as in lifting copes and molds, drawing patterns and moving cores, the air hoists will do 50 per cent more work in an easier and better manner, without the danger of losing castings and with considerable saving in repairs. The peculiar adaptability of this device, properly rigged, as a drop or casting breaker, is apparent, since it is evident that the sudden release of the load could not possibly affect the regular and even progress of the piston in its return stroke. This machine will break three half-pigs into three pieces each, in one minute, and can easily break 20 tons of pigs while a man is breaking up one ton by the old sledge method.

The motor chain hoist is a more recently developed appliance, intended for similar service, and embodies compactness of form with rapid, even speed and perfect regulation. It consists of the motor familiar to all users of pneumatic drills, so combined with a chain hoist as to permit quick movement, accurate suspension of load and prompt reversibility. One of the latest types operates the motor in a bath of oil, avoiding the annoyance sometimes due to insufficient lubrication because of the inaccessible location in which the hoist must operate. These hoists, with adequate pressure, are made in sizes to lift up to 10,000 pounds in weight, at speeds varying from 10 to 36 feet per minute.

A most useful foundry appliance, familiar to you all, is the pneumatic hammer for chipping castings; in fact, so general has become the adoption of this invaluable tool, that the mere presentation of it in the accompanying views, showing a few of its best known forms of application, will suffice, supplemented by the general statement that one man with one of these tools will customarily do the work of four men following the old methods.

The air drill is another very familiar labor-saving device in some classes of foundry work, though more peculiarly a tool possessing a wide variety of usefulness in the shop, where for drilling, reaming, rolling flues, and other applications seemingly limitless, it has established itself, next to the pneumatic hammer, as the most generally used type of air tool. When a large, heavy casting is to be broken up for return to the cupola, a small pneumatic drill may be advantageously used to drill a suitable number of small holes into which may be inserted a round taper steel wedge which, with a few well directed hammer blows, will sever the piece into parts suitable for remelting.

The application of the drill motor equipped as a casting cleaner, will appeal to you as a saver of labor and money without further argument when its immense speed and power are considered.

One of the most recently perfected pneumatic devices suitable only to foundry requirements, is the pneumatic sand rammer. Accurately counterbalanced, the weight of this tool comelse, the proverbial ounce of prevention saves the pound of cure. Experienced knowledge which the compressor maker or pneumatic tool manufacturer is ready to provide, coupled pletely rigged is not quite 300 pounds and operated under an air pressure of 40 pounds per square inch it will deliver an average of 300 blows per minute. The maximum stroke is 7 inches, but the length of stroke and consequently the number of blows delivered, may be changed at the will of the operator by simply varying the proximity of the rammer to the work. It is estimated that a greater quantity of sand can be rammed in a more effectual manner by this machine, than five men can do by hand.

Passing from the sand rammer, possibly the newest of pneumatic contrivances to serve the foundryman's needs, we reach what to me seemed to be the oldest and one of the most widely known, though perhaps not most widely used, of them all—the pneumatic sand blast. Embracing a broad field of application and in some way adapted to the needs of almost every known form of foundry work, the adoption of the sand blast has been retarded somewhat through patent limitations and ultra-conservative methods of introduction. Another objection has been its wasteful utilization of what was formerly a most expensive commodity — compressed air — but this element of criticism is eliminated in a great measure because of the rapid strides in the development of economical and efficient air compressing machinery. The value of the sand blast for foundry use, if obtainable at proper operating cost, being universally conceded, I will sum up my reference to this device by quoting from the pamphlet of a manufacturer, treating the subject from an argumentative standpoint:

The question is asked, does the sand blast pay, for foundry use? And is answered with the qualification that it is difficult to approximate on general work. The argument continues, that on ordinary iron, steel, brass and bronze castings, one man operating a sand blast apparatus consuming 120 feet of cubic air per minute, will clean more surface and remove more cores in a given time than is possible for from six to ten men to do with the hammers, chisels and brushes, and the finished work left by the sand blast is infinitely better than can possibly be produced by hand laborers. Burned sand or scale is removed rapidly by the blast, and not only does it effect a great saving in time and labor, but a further saving is effected on castings to be machined; the removal of the oxide in itself is a great saving on tools, and in many cases the tools can be run at an increased speed. This applies particularly to milling cutters. Difficult and intricate cores are readily removed, and in cleaning steel castings in which large quantities of wire nails are used, the sand is eaten away first, and subsequently the nails will fall to the ground, sand blasted, perfectly clean, and in condition to be used over again. In a number of foundries where the sand blast has been introduced, the use of facings has been discontinued. In some cases the only objection in fact, that has been made to the sand blast is an unpleasant habit of making defects too plainly discernible.

Another recent improvement in connection with the sand blast is the application of it in conjunction with tumbling barrels. These barrels run very slowly and consequently there is slight risk of breaking a fragile casting; neither are the edges of them worn off and destroyed, as in the case of ordinary rattling a high speed. The castings are not cleaned by tumbling, but by sand blast inserted at one or both ends of the barrel.

*From a paper prepared for the January meeting of the Foundrymen's Associations.

The usual time consumed in cleaning a charge of this barrel is from 20 to 30 minutes.

The pneumatic sand sifter represents another method of utilizing the air drill motor for the needs of the foundry. With compressed air available for its operation, the value of this apparatus through saving of labor and attention becomes readily apparent. It can be moved from place to place in the performance of its work, saving the time and labor otherwise required to convey sand to a fixed sifting point.

I have refrained purposely from any detailed reference to the pneumatic molding machine, a most important feature of compressed air foundry equipment, because the economy and value of this device have been so recently placed before you in a paper devoted exclusively to the subject. Suffice it to say that the pneumatic molding machine presents in itself a most potent argument for the introduction of the air compressor in foundry service.

The pneumatic painting machine is a simple form of compressed air device deserving a place in this paper, because of its exceptional economy for painting the interiors of foundry buildings. One man with this handy utensil can cover more space and distribute the paint more evenly than four men using ordinary paint brushes. The air consumption is moderate and the results all that can be desired.

There are, of course, numerous special employments of compressed air in foundry work peculiarly adaptable to individual conditions but not of general interest or application, reference to which is not within the province of this paper, but such applications, suggest the inevitable conclusion that when once you have compressed air available, the number of convenient and economical possibilities that it presents to the progressive operator is surprising, and its field of usefulness in your service broadens with amazing, but none the less gratifying, rapidity. Second only to electricity in its fascinating possibilities, compressed air yields nothing to electricity as a power with properties peculiarly its own, inimitable and unsurpassed in the commercial development of our time, and with the constantly rising standard of efficiency in air compressing machinery, that most important source of power which regulates the value of pneumatic appliances, more widespread adoption is inevitable. Imperfect and wasteful air compressors, possessing the primary virtue of cheapness but with all the faults in the mechanical calendar, will do more to offset the resultant value to be derived from the use of pneumatic foundry equipment, than labor antagonism, either secret or expressed. Therefore, to derive the utmost benefits from the installation of compressed air machinery, the selection of a compressor should be carefully considered. It is unwise to install a compressor just about equal in capacity to present requirements good practice being to provide a compressor at least 50 per cent greater in capacity than immediate necessities demand. Compressors of the duplex type are divisible, permitting the installation and operation of one-half at first, and the other half when the additional capacity is needed. The theoretical capacity of an air compressor stated in the list of the maker, is not the equivalent of the actual volume of air needed for the service. All makers list their compressors according to theoretical measurement, but the efficiency of the compressor is determined by the volume of air actually delivered with a given consumption of power. The cheap air compressor usually proves the most expensive. If a water pump fails in its work, or if a steam engine is deficient, the short-comings are self-evident, but if an air compressor is poorly designed or badly constructed, it may continue in the evil of its ways until the scrap heap claims it for its own; unless, as is more likely, an absolute breakdown calls attention to its deficiencies and shows, all too late, that the hole it has made in the coal pile, added to the cost of keeping it in repair, would have paid a handsome interest on the additional first cost of a properly designed and properly constructed compressor. Second-hand compressors are poor investments, unless known to have given satisfaction in service similar to that for which intended, and, in any case, the working parts should be carefully examined to see that they retain their full measure of usefulness. An air compressor with valves, pistons, etc., worn out or in bad repair, can waste a great amount of power.

The use of air brake pumps and direct-acting compressors is a very bad practice, as statistics show that their steam consumption is about five times that of a crank and fly-wheel compressor for the same volume and pressure of air delivered. Install a steam-driven compressor, if your steam supply is plenty; otherwise a belted compressor may serve best.

Intake air to the compressor should not be drawn from a hot engine room, or from any point where dust is abundant. The volume of air delivered by the compressor increases proportionately as the temperature of the intake air is lowered, and dust or grit entering the compressor clogs the valves, cuts the cylinders and generally impairs the efficiency. The selection of an air receiver should have careful consideration. Compressed air under 100 pounds pressure will leak a horsepower through a 1-16th inch diameter hole in five minutes, and a well made, strong and tight air receiver is the second essentially important factor if you would realize to the utmost all the advantages which compressed air provides.

Test the air-piping under full pressure when it is installed and at regular intervals thereafter, allowing the pressure to remain an adequate length of time, and if the gauge indicates leakage, locate and remedy it. To secure the best results and eliminate moisture from the compressed air, connect your pipe leading from the compressor to the top of the receiver, and lead your air pipe to points of consumption from the bottom of the receiver. Proper provision should be made for draining condensed moisture at regular intervals in the system. The simplest method is to slightly incline the branches leading from the main line and insert drain cocks before the hose connections are reached. In pneumatic equipment, as in all things with sound calculation, will assure the highest results and utmost economy. Whether to put in a steam-driven or belt-actuated compressor; whether it should be of the duplex or single type and have simple or compound cylinders; where best to locate the compressor and where to place the receiver; what size of receiver is adequate; whether the size of the plant warrants provision for reheating the air, all these are points requiring careful consideration. In installing pneumatic equipment it is generally desirable to procure the entire outfit from one source. Thus division of responsibility for the successful operation of any feature of the plant is avoided, and one guarantee covers everything.

Beginning of the Graphite Industry.

Graphite has the following that is of interest to users of crucibles and other graphite products:

"So far as yet known Ceylon holds the largest and richest deposits of graphite and the world is indebted to Ceylon for its largest supply. The next best source of supply are the now equally famous Ticonderoga mines of the Joseph Dixon Crucible Co. In a paper read before the Ceylon branch of the Royal Asiatic Society we are told 'that the export of Ceylon graphite must have commenced between 1820 and 1830, as Mr. Joseph Dixon, the founder of the great American Crucible Co., obtained a shipment of Ceylon plumbago in 1829.'

"Turning to our own records, we find that Joseph Dixon, the founder of the Joseph Dixon Crucible Co., in the year 1827 made crucibles by using the plumbago found in the state of New Hampshire. The quality was so far superior to the Dutch blacklead pots, that the melting-pot business was completely revolutionized, and the Dixon graphite (frequently called plumbago or blacklead) crucibles became the standard. Mr. Dixon afterward saw specimens of graphite that had been brought from Ceylon as curiosities by captains in the East India trade; and, finding them so much better than the New Hampshire plumbago, he procured a shipment, which was the first importation of Ceylon graphite into the United States. The graphite industry, therefore, really begins with the founder of the Dixon company."

December was another notable month for the cars and locomotives ordered. Our records show that orders were placed for 18,431 cars of all kinds and 429 locomotives. This is the largest number of locomotives ordered in any month last year and the largest number of cars, excepting in November, when the orders amounted to something over 20,000. The December car orders are divided as follows: Box, stock and refrigerator cars, 10,158; coal and ore cars, 6,045; flat cars, 1,950; tank cars, 43; and passenger cars, 235. Of the locomotives 133 were for passenger service, 263 for freight and 33 for switching service.—[Railroad Gazette.

EXPANDED METAL BY A NEW PROCESS

George A. Turnbull, a resident of Chicago, has devised and patented after several years of experimental work a machine for rolling expanded metal. The growth of the expanded metal industry within recent years has been enormous. The annual output in this country at the present time is in the neighborhood of 18,000,000 square yards, which, owing to its perfect adaptation to fire proof construction, finds ready sale. Some idea of the extent to which expanded metal is used is conveyed by the fact that approximately 10,000,000 square yards, most of it furnished from the United States was used in the construction of the buildings of the Paris Exposition alone.

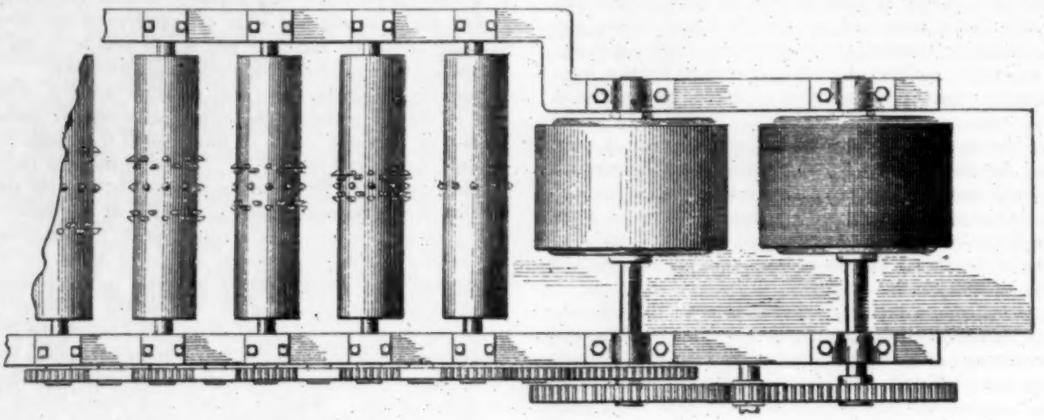

FIG. 1.—MACHINE FOR MAKING EXPANDED METAL. TOP PLAN VIEW.

One difficulty has always presented itself to manufacturers: The process heretofore used in manufacture has been too slow. The machines have been constructed to work by a shearing process and the expansion has been effected by the shearing. The operation has been as follows: A strip of a desired width, say seven inches or more, and 8 ft. long, is placed upon a table and a reciprocating cutter operating longitudinally of the sheet cuts and expands one row of webs at a time. It is obvious that this process is exceedingly slow, and the best machines heretofore devised have averaged in the neighborhood of 400 yards per day. It has been rare that an output from a single machine has equalled 600 yards.

Mr. Turnbull's machine comprises a frame having journaled at the front or feed end one or more pairs of cutting or slitting rolls one of which is provided with a plurality of knives arranged staggering on the periphery and a sufficient distance apart to form cuts of a desired length and distance apart in a sheet of metal passed between the rolls. The distances at which the knives are set will depend, of course, upon the size of the web and the use for which the expanded metal is designed. When used for rolling expanded metal lath of the kind illustrated, this being also one of Mr. Turnbull's inventions, they will be set one-eighth of an inch apart, thereby providing webs one-eighth of an inch in width between the slits. The knives may be secured on the periphery of the cutting rolls in any desired manner, and if preferred may be adjustable thereon, to adapt a given machine to adjustments for different expansions of the metals. In some instances it may be convenient to have alternate knives on opposite rolls.

At the rear of the cutting rolls are located forming rolls, which are of the same size as the cutting rolls. The forming rolls receive the slit metal from the cutting rolls and form it preparatory to the expansion. They are provided on their peripheries with co-acting forming dies and punches so adjusted with respect to the cutting rolls that when the cut sheet is fed between the forming rolls, alternate punches engage centrally on the cut edges of the web, while the central portion of the webs are supported on V-shaped dies. The result is that the co-action of the punches and dies and the rotation of the rolls act to force the cut edges in one direction while the central portions of the web are forced oppositely, with the effect of forming a succession of open pockets, alternating with V-shaped ridges. Obviously the cut edges may be all turned in one direction and the V-shaped ridges in the other. Or if preferred they may alternate, thereby providing a means for forming the sheet preliminary to making several different forms

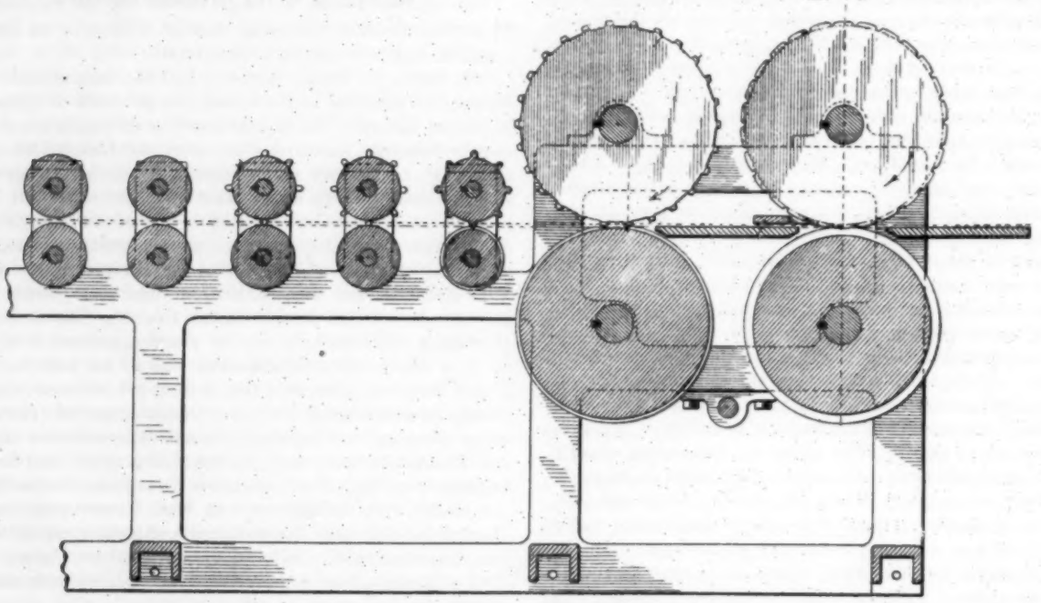

FIG. 2.—LONGITUDINAL VERTICAL SECTION.

of lath. Several pairs of forming rolls may be provided if desired but this will not ordinarily be necessary.

In position to receive the sheet as it comes from the forming rolls are a plurality of pairs of expanding rolls which as shown are of less diameter than the cutting and forming rolls, but are geared to have the same peripheral speed, thereby permitting the expanding means to operate on the sheet as it comes from the forming rolls. The machine may be arranged to expand either from the edge of the sheet across it or from the central part toward the opposite edges. In this description reference will only be made to the latter method. The expanding rolls are a sufficient distance apart to guide and steady the sheet, but exert little or no pressure thereon. At the middle of each of the upper expanding rolls is arranged a peripheral row of guide and expanding pins designed to engage in the central longitudinal line of openings. These pins are bluntly pointed and when forced into the openings of the sheet between the V-shaped ridges, act to force the sheet laterally and thereby partly expand the next succeeding line of openings by the outward thrust upon the webs. Starting then with the first upper expanding roll provided with guide pins as stated, the next succeeding upper roll is provided not only with the guide pins but also with one or more rows of expanding pins arranged on each side of the guide pins and staggering with respect to each other and the guide pins and so spaced as to exactly engage in the slots or pockets one each side of the central pocket. The points of these pins preferably incline outwardly so that their thrust when engaging the sheet is lateral and outward.

In the machine when set for expanding the metal with one-eighth inch web the expanding pins will be set a distance between centers sufficient to give the required expansion, ordinarily one-fourth inch. Each succeeding upper roll is provided with one or more lines of guide pins adapted to hold the sheet accurately upon the roll and with two or more rows of expanding pins arranged on each side of the center, and on succeeding rolls diverging from the center towards the end of the roll. The lower or complemental rolls of each pair are provided with sockets adapted to receive the ends of the expanding and guide pins, thereby permitting the rolls to support the plate or sheet during the expansion.

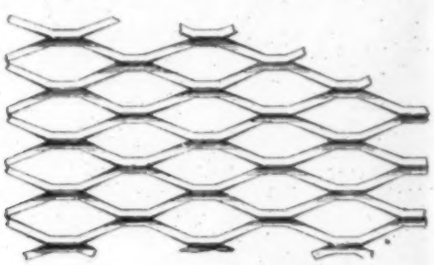

FIG. 3.—EXPANSION COMPLETE.

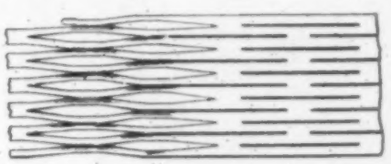

FIG. 4.—METAL SLIT AND PARTLY FORMED.

The operation of this form of the machine when set for expanding from the center is as follows: A sheet of metal of desired width, say 7½ inches, and of any desired length is fed into the cutting rolls and slit in a plurality of relatively short longitudinal overlapping slits and on the next rolls formed. It is then passed through the expanding rolls. As the end of the sheet reaches the first pair of expanding rolls the central guide pins thereon engage in the central line of pockets and expand this line of pockets to the desired width and start the expansion for the next succeeding line or lines of pockets by the thrust of the webs upon the next succeeding pair laterally permitting the expanding pins on the next roll to engage in the succeeding pockets. This operation is repeated progressively and uniformly as the sheet proceeds through the rolls until the expansion is complete. Any method of adjusting the expanding roll, forming rolls or cutting rolls with respect to each other may be used. Or in the case of the expanding rolls, if preferred, screw threaded sockets may be so disposed on the rolls as to permit the pins to be adjusted for different expansions.

The machine if desired may be set to expand wholly from above the sheet, or from below the sheet, or one set of expanding pins may be arranged on the upper rolls and the alternate set on the lower rolls thereby making a slight difference in the appearance of the expanded metal, the machine, however, operating equally well.

The inventor of this machine is a pioneer in this industry and has taken out many patents on sheet, lath and expanded metal. He has also designed and constructed successful machines for manufacturing various forms of metallic lath, many of which are now in use. He early conceived the idea of manufacturing expanded metal by the rolling process, and after several years passed in experimenting has devised the present machine. The invention has been submitted to the examination of a number of expert engineers, who have not only pronounced it thoroughly practical, but have agreed that an output of 4,000 or 5,000 yards per day will be possible for each machine. Mr. Turnbull's patent recently issued was secured through Charles W. Hills, 1527 Monadnock Building, Chicago, Ill., and the claims are sufficiently broad to cover in combination with any cutting means any movable expanding means acting to expand the sheet laterally. Foreign patents are pending.

The German Iron Trade and American Imports.

The condition of the iron and steel trade in Germany is the subject of an extensive paper from Consul C. E. Barnes at Cologne. One extract from the report is as follows: "For the last seven years the German iron industry has been steadily growing, the yearly increase in production during the last three years amounting to a trifle over 500,000 tons. During this period, owing to the ever increasing demand, prices have also steadily risen, so that an exceptional period of prosperity was experienced. With the outbreak of the war in China, and also influenced by the protracted war in Africa, trade in general received a decided check toward the latter half of July, and since then the iron and steel market, in common with nearly everything else, has been falling steadily. The high freight rates have been very prejudicial to the import of American material, but with the enormous increase of the tonnage recently reported freights have dropped considerably, and as it seems likely that for some time the tonnage will be in excess of requirements. American exporters should have a good chance of competing successfully in the European markets, especially as the price of fuel still remains very high and at present shows no signs of falling to any appreciable extent. The depression has made itself most felt in the bolt, nut, rivet and kindred trades, prices being at the present moment 60 per cent lower than in the summer and still falling, and makers being ready to accept orders at almost any price. The large engineering and similar works are at present fairly well employed, but many smaller ones feel the depression and have to discharge some of their men, while the larger works all note a decrease of orders coming in, pointing to a slack time as soon as the work in hand is completed."

Writing from Frankfort, Vice Consul-General Hanauer says: Mr. Wiegand, the director-general of the North German Lloyd Steamer Co., at a public festival recently, made a speech in which he defended his company against the attacks made on it by German industrial circles on account of the company's late purchase of 1,000 tons of steel in the United States. The director said: "We have during the six years past paid to German industries over $30,940,000. The order given to American steel works, amounting to about $70,000, is insignificant compared with these figures. It is not to save 10 per cent in price that this order was given to a foreign concern, but the Lloyd company would not have reached its present position had it not utilized the improvements offered by outside manufacturers. We would like to see German industry brought to the utmost tension by foreign competition and not afraid to meet it at home; only thus is it possible for us to maintain our place in the international contest for economic fitness".

IMPROVEMENT IN BLAST FURNACE HOISTS.

Of the improvements which have been made in recent years in the manufacture of pig iron few are equal in importance to the charging device which does away entirely with top fillers. By this means the personal equation is entirely eliminated, and a furnace so equipped will be properly filled under all conditions, regardless of the weather or the disposition of the workmen to do their work properly. Laborers as a rule do not appreciate the importance of filling the stack with equal distribution all around the periphery of the bell, and experience shows that they deliver it where they were caused the least inconvenience and trouble. If there happens to be a cold rain blowing from the north the workman will probably deliver the charge on the south side of the furnace and vice-versa. Labor troubles must also be taken into consideration, and in time of wage differences men have been known to charge furnaces in such a way that they would work badly. In addition the automatic top filler if properly designed prevents the escape of a large volume of gas which ordinarily takes place with the old style top filling arrangements. This gas is used in the generation of steam and the loss in an old type furnace is from 15 to 30 per cent of the gas produced every time the furnace is charged.

One of the principal difficulties encountered, however, in attempting to fill blast furnaces by means of the skip hoist is to get operators that will run the skip with the same velocity as it approaches the point where the charge is to be dumped into the furnace. When the charge is brought up the incline very rapidly and is brought to a sudden stop, there is a tendency on account of the acquired speed to project the material across the opposite side of the hopper in a mass. On the other hand where the charge approaches the end of its travel too slowly the material would not have the required momentum to carry it beyond the nose of the skip, and the latter would be turned so slowly that the material would dribble into the hopper, falling vertically from the edge of the skip nose and landing on the side of the bell towards the skip. The difficulties resulting from this irregular manner of filling have been particularly noticeable at a number of blast furnaces in the Pittsburg district causing the irregular working of the furnace, high coke consumption, irregular output, scaffolds, and undue wear on the lining.

A device has recently been patented by Walter Kennedy, mechanical engineer, of Pittsburg, Pa., by which the speed of the cars as they leave and approach the upper and lower ends of their traverse is regulated automatically. In the accompanying drawings Fig. 1 is a view in elevation of a blast furnace and the hoisting mechanism, showing the winding drum, while Fig. 2 is an end view of the winding drum. The apparatus, though very simple and inexpensive, has proved very effective and is being quite generally adopted. As shown in Fig. 2, the device consists of a cam connected to a winding drum by means of gears, in such a way that the cam makes one revolution while the skip is traveling the entire distance. The motion from the cam is connected to the steam valve in such a way that the steam is automatically cut off in the main pipe leading to the engine allowing only a small opening which may be regulated by the blast furnace manager to give any required speed to the skip while approaching either end of the traverse. After the valve has been set it should be locked to prevent its being tampered with by unauthorized persons. The valve can be operated from the cars as they pass along or from the engine. A desirable construction for operating the valve from the engine as shown in Fig. 2 consists of a disk loosely mounted on a counter shaft and driven by suitable interposed gearing from the shaft of the winding drums so as to make one revolution while the car is moving from the bottom to the top of the tracks. This disk is provided with a groove for the reception of a pin or roller on the rod which is connected to the stem of the regulating valve. The groove is so shaped that when the pin or roller is at one point the valve will be closed and when the disk is rotated in either direction the valve will be gradually opened, the full opening of the valve being effected by the time the car has moved 30 or 40 feet, more or less, from one end of the track. In lieu of operating the valve from the engine it may be connected to an electrically controlled mechanism of any suitable construction thus operating it from the cars as they pass certain points on the tracks.

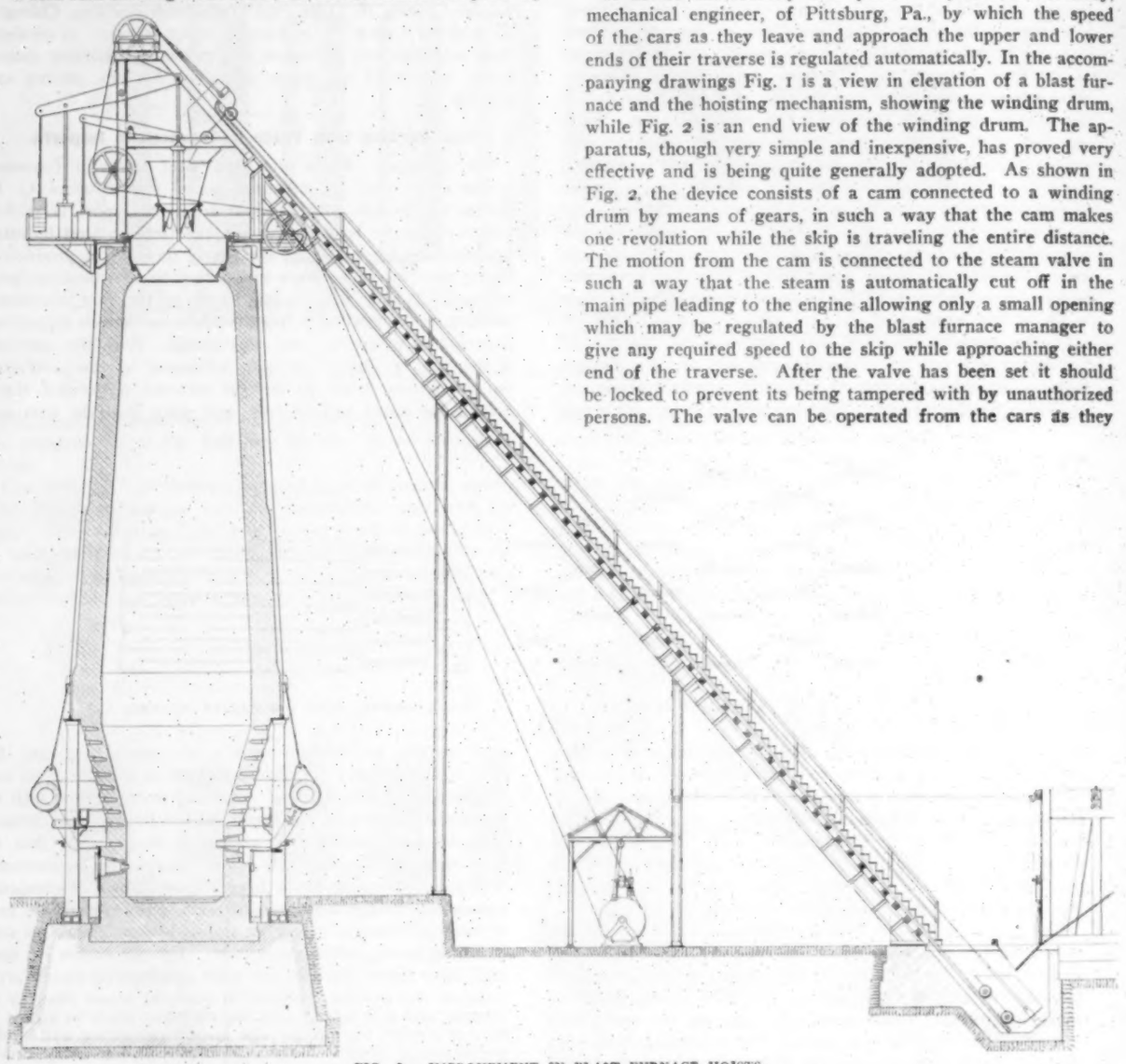

FIG. 1.—IMPROVEMENT IN BLAST FURNACE HOISTS.

EXPERIMENTS WITH TITANIFEROUS ORES.

BY WM. GILBERT IRWIN.

For some months a series of experiments with titaniferous ores have been conducted at Niagara Falls, N. Y., under the direction of the Ferro-Titanium Co., a newly incorporated concern, whose aim is to discover a cheap method of producing a ferro-titanium metal. While there are large deposits of iron ore containing a greater or less percentage of titanium, located in different parts of the country, particularly in the eastern states, the great difficulty experienced in smelting such ores has heretofore rendered them practically useless to iron manufacturers. It is estimated that not less than 30 per cent of the iron ore on this continent contains more or less titanium.

Until a comparatively recent date it was not thought possible to work iron ore containing titanium, inasmuch as the titanic acid produced in the smelting process made an infusible slag. Iron workers have accepted as final the judgment of those who have declared this to be a fact. Yet titaniferous iron ore has been worked in this country and abroad. As early as 1851 a gold medal was awarded to American steel by the London Exposition, the subject of this award being steel manufactured from Adirondack ore which is highly titaniferous. Before the introduction of the Bessemer process titaniferous ore was worked in England, a large percentage of limestone and silica being added to the ore in order to flux the mass in the furnace.

The experiments and researches at Niagara Falls are in charge of Auguste J. Rossi, who is the inventor of a new method for the handling of titanium ores, by which the titanic acid involved is treated as is silica in other furnaces. In the experiments being conducted no silica is added to make a slag, this being done by the addition of a dolomitic limestone. The only silica used is that which is brought to the furnaces in compound with other substances. The modern tendency is to mix the so-called hard ores with hematite ores to produce the best iron. So great has been the demand for silicious ores, which are confined in this country chiefly to the Lake Superior district that ores containing as low as 35 per cent of iron have been transported from Lake Superior to the Pittsburg district. The titaniferous ores of the Adirondack mountains contain as high as 64 per cent iron and from 10 per cent to 18 per cent of titanum. They are free from sulphur and phosphorus, and should the experiments now being conducted at Niagara Falls prove entirely successful these ore deposits will undoubtedly play an important part in the future of the iron and steel trade.

At present about 500 pounds of ferro-titanium are being made daily by the Niagara Power Co. and this new alloy is being used by iron and steel manufacturers in different parts of the country. A ferro metal is used to impart certain desired qualities to steel. Just why it works the improvements produced in this metal is still beyond explanation. In the steel making processes in vogue to-day ferro-manganese, ferro-nickel, ferro-chrome, ferro-tungsten and ferro-molybdenum are all extensively used for obtaining special results, each alloy imparting a certain desired property. At present the cost of each of these alloys is quite considerable and the introduction of a cheap alloy, the end to which the Niagara Falls Power Co. is working will have a material effect upon the steel market.

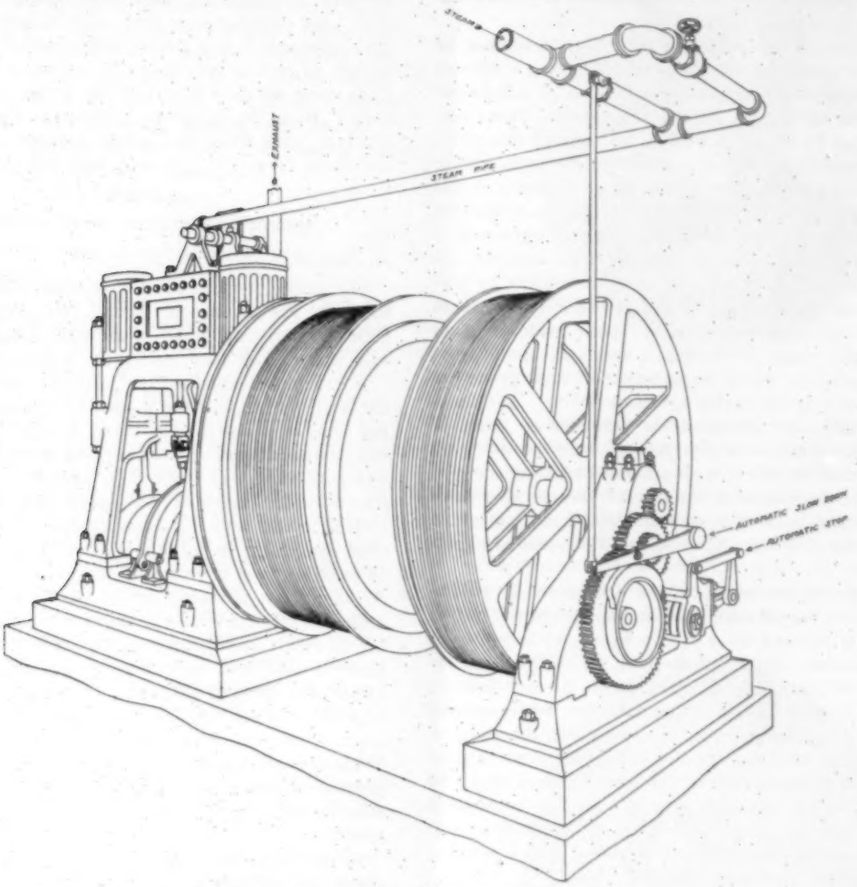

FIG 2.—IMPROVEMENT IN BLAST FURNACE HOISTS.

The Jeansville Iron Works Co., Jeansville, Pa., has recently closed a contract with the Lebanon, Ky., Water Works Co., for a 1,000,000-gallon triple expansion pumping engine; the Montana Ore Purchasing Co., Butte, Mont., for two compound condensing mine pumps and two duplex jet condensers; the Butte Consolidated Mining Co., Butte, Mont., for a triple expansion mining pump for a 1,400-foot lift, and a 1,000,000-gallon compound mining pump with a 600-foot lift. It has also closed a contract with the Consolidation Coal Co., Frostburg, Md., for a 2,000,000-gallon capacity mine pump designed expressly to be operated by compressed air, and a 7,000,000-gallon capacity mining pump, for the Jefferson & Clearfield Coal Co., near Reynoldsville, Pa.

The plant of the Pine Iron Works Co., near Pottstown, Pa., has been leased to the Luckron Iron & Steel Co., Luckron, Pa., and will be operated.

IRON MINES OF HARTVILLE, WYOMING.*

BY H. M. CHANCE, PHILADELPHIA.

The iron ore deposits of the Hartville district are located near the new town of Guernsey, about 100 miles north of Cheyenne. The writer has been familiar with them since 1887, having visited the district several times for different clients—his last examination having been made in November and December 1897. The deposits extend in a general northeast-southwest direction from a point in section 33 range 65 west, township 28 north, on the west side of Whalen canon, through sections 4, 5, 6. 7 and 8 of township 27 north in the same range and over into sections 1 and 12 of township 27 north, range 66 west.

The ore is a remarkably pure red hematite, extremely low in phosphorus, and carrying a small percentage of silica, as shown by analyses given below, and similar in many respects to the red ore deposits of Michigan and Wisconsin, occurring like them in lenticular bodies of extraordinary thickness, enclosed in a slate formation.

Four large bodies of this character have been developed by shafts, drifts and open cuts; and it is probable that a number of similar ore bodies exist within these limits and will be developed from time to time as mining progresses. These lenticular bodies may be considered either as isolated masses of ore or as enlargements occurring at intervals along the course of veins of moderate thickness. Nearly all ore-deposits of this character may be so described; and I believe the developments here indicate that these large bodies of ore are enlargements of veins which extend as unbroken sheets of ore for considerable distances. While the developments are not sufficient to permit an estimate of the quantity of ore available within these limits, sufficient development work has been made to place practically in sight, ready for mining, a very large quantity of high grade material, so that a large output of high grade ore can be maintained unquestionably for many years. This statement includes only ore averaging 62 per cent or more of metallic iron. In addition to the large quantity of this high grade ore which can be relied upon without including the possibilities of future discoveries in the district, there is also available an equal quantity of what may be termed medium grade ore, that is, ore ranging from 52 or 53 to 60 per cent of metallic iron.

Besides the known ore bodies, there are numerous indications of the existence of others of similar character. Most of the district is covered by a nearly horizontal capping of sandstone or quartzite, 100 to 200 ft. thick, which lies upon the upturned edges of the older slates in which the ore deposits occur; and it is only in the gulches and canons, where erosion has cut away and removed this cap rock, exposing the underlying slate formation, that the ore bodies can be seen. Future development will doubtless show that they extend along he trend of the formation, beneath this cap rock, far beyond the points at which hey may now be seen and the deposits so hidden may prove as large and valuable as those upon which existing developments have been made.

In addition to the lenticular ore bodies the district contains deposits of another class of deposits, which I term secondary or replacement deposits occurring above the slates in or near the base of the cap rock, and sometimes connected with replacement deposits in partially disintegrated siliceous limestone. The accompanying map shows a large number of drifts and shafts opened in the sides of the hills at this horizon, usually at an elevation of from 50 to 150 ft. above the valley. These deposits or veins show a slightly inclined or horizontal stratification. They exhibit peculiarities, plainly indicating that the ore which they contain has been derived from the erosion of the lenticular deposits; in other words, this ore is probably debris from the ore veins and ore bodies occurring in the adjacent slates and was deposited in nearly horizontal layers upon the upturned edges of the slates or in the siliceous cap rock, during the deposition of the latter. Scores of openings show deposits of this class. Many of them contain, or consist principally of, water-worn rounded boulders of ore, cemented together by a ferruginous or siliceous matrix. As a source of ore supply these deposits are possibly of small value. But their great extent and their wide distribution over a large area clearly indicate that the ore bodies from which they derive their material, and which are probably now hidden under the cap rock, are large and possibly numerous. In the immediate vicinity of the large ore bodies exposed in the canons more modern deposits of a similar nature can be seen at a number of points, and some of these, owing to the fact that the ore-nodules or boulders of which they consist are not cemented together, may be worked to advantage, and will yield considerable quantities of high grade ore in the form of boulders or pebbles.

*From a paper read before the American Institute of Mining Engineers. It is expected that these Wyoming ores will be shipped in large quantities to the furnaces of the Colorado Fuel & Iron Co. at Pueblo, Col.

Quality of the Ores.

The hard red ore, locally called "blue ore," is almost invariably richer than the soft ore; but there is also much high grade soft ore. An average of 17 analyses of ores from this district, all made from samples taken by disinterested experts, shows, for the hard blue lump ores: iron, 66.13; silica, 2.90; and phosphorus, 0.038 per cent. Three samples of the soft red ore gave: iron, 59.99; silica, 8.92; and phosphorus, 0.010 per cent. My own samples were slightly better than these averages although I was particularly careful to get an average sample of each grade of ore by taking a quantity at random from many different points on the dump. These samples were mainly from the openings in Sunrise Park. Two of them, however, were from the Chicago (Happy Thought) openings; and these showed for the hard and soft ore:

Chicago Ore.

	Hard Ore. Per Cent.	Soft Ore. Per Cent.
Iron	62.35	58.75
Silica	9 12	11 86
Phosphorus	Trace.	Trace.

The smelter returns from over 5,000 tons of ore shipped from the Good Fortune deposit during July, August, September and October, 1897, embracing 36 different returns of average analyses, show: iron, 62.4; and silica, 6.4 per cent.

It should be explained that this ore was mined in an open-cut, and that, in blasting a considerable quantity of the hanging wall was continually being knocked down, and became mixed with the ore. Moreover, the ore was hauled in wagons, and part of it was frequently unloaded on bare ground and then reloaded, more or less gravel and dirt becoming mixed with it in this way. If carefully mined and loaded into railroad cars at the mine, this ore would certainly have averaged 65 or 66 per cent of iron with not over 3 to 4 per cent of silica. As shipped, it is mainly of the harder variety, but contains a little soft ore. It is safe to say that the total output of hard ore can be relied upon to average 64 per cent of metallic iron, and that the silica will not exceed 3.5 per cent. The soft ore will range from 58 to 62 per cent, averaging say 60 per cent in iron, with about 8 per cent of silica; and, with care in mining, the silica in the soft ore can probably be kept down to 6 per cent. If about equal quantities of the hard and soft ore be mined, a product of about the following grade can be obtained: iron, 62.00 or more; silica, 5.00 or less; phosphorus, 0.04 or less per cent.

In the above statement it has been intended to indicate the grades of ore that can be relied upon absolutely in thousand ton lots to yield not less than the percentages named. The actual results will probably be better than these figures, by a very considerable margin.

The Ore Bodies.

The four great ore bodies opened in the Hartville district are located as follows: (1) The Sunrise ore body, and (2) The Village Belle-Lone Jack ore body, in Sunrise Park; (3) The Good Fortune ore body, ¾ mile east; and (4) The Chicago (Happy Thought) ore body, 1½ mile northeast of Sunrise Park. The Sunrise deposit has been opened to a depth of 110 ft. in search of copper, showing it to be about 100 ft. thick and to extend laterally along the trend of the formation at least 900 to 1,000 ft. Dr. Ricketts, as territorial geologist, estimated that this deposit would yield 750,000 tons for every 85 ft. in depth on the deposit. The vein is inclined at a high angle, and doubtless extends to great depth.

The Village Belle-Lone Jack ore body is opened at several places for a distance of about 800 ft. The developments were made in search of copper, and do not clearly show the thickness of the deposit, but indicate that it ranges from 15 up to possibly 50 ft. or more in thickness. It doubtless extends into the hills far beyond the last opening made upon it. It has

been developed to a depth of 50 to 70 ft. by a numbr of shafts, all of which struck high grade iron ore.

The length of the Good Fortune ore body is not known, but the surface indications warrant the belief that it is several hundred feet long. It has been developed by the workings of the Good Fortune mine for about 100 ft. in length and about 60 in depth, showing a maximum thickness of about 30 ft., of which over 20 ft. is high grade ore.

The developments on the Chicago ore body are sufficient to prove the existence of a large deposit and indicate a thickness of perhaps 50 ft. or more and a lateral extent of several hundred feet; but the prospecting was not intelligently directed, and while a large amount of work was done, it was not done in a way to show precisely either the thickness or extent of the ore body. It is clearly a large and important one.

In addition to these four great ore bodies, there are others which have been partially opened, and there are three localities in which large ore bodies probably exist, but in which the ore can only be reached by boring or by shafts 150 to 250 ft. deep. An expenditure of a few thousand dollars at these places will probably result in the development of deposits containing millions of tons of ore. Many thousands of dollars have already been spent in this district in the prosecution of poorly planned work, which could not be expected to develop large bodies of good ore, but this was largely due to the fact that most of this work was done in search for copper deposits.

Long Campaign of an Anthracite Furnace.

An unusually long run, that closed with the furnace in remarkably good condition, is reported by the Andover Iron Co., of Phillipsburg, N. J. The furnace is 75 feet high, and has 16-ft. bosh, 9½ ft. hearth and 12-ft stock line. On the last run it was lit December 15th, 1895, and the blast was taken off December 15th, 1900, making a run of exactly five years. From the hearth to the mantle the furnace is in perfect shape, good enough for another run of five years or more. The lining is generally good above the mantle, only one thin place developing over a very small area about 15 feet above it. This weakness, however, necessitated blowing out the furnace. Of the 52 bronze bosh plates put in but one had to be renewed and that one lasted until within a very few weeks of the close of the blast. The furnace made 197,162 tons of iron, the fuel used being chiefly anthracite, with some coke. The ore was chiefly a dense magnetite mined by the company, and the flux a magnesian limestone quarried by the company close to the furnace. The ore was very uniform in composition, running in iron 57 per cent, silica 10 to 12 per cent, phosphorus .30 and sulphur a trace. The limestone ran from 6 to 8 per cent in silica.

The blast was commenced with three 4-pass fire brick stoves 18x65 feet in poor order. The second and third years they gave very poor service and one or another was off for repairs a considerable part of the time. This state of affairs got so bad that in the summer of 1900 a stove slightly used, 16x81 feet, was purchased and erected. This additional stove permitted of repairing the three old stoves leisurely and carefully. The production of iron was also restricted by lack of capacity in the hoist which was an old style, slow moving automatic lift. The blowing capacity was ample. The air was driven into the furnace through seven 5-inch tuyeres. The iron made was chiefly foundry and mill irons, with a small amount of basic iron.

William Tod & Co., of Youngstown, O., have been awarded a contract by the American Steel & Wire Co., for a 47x72-inch return crank blowing engine, to be installed at the Cleveland Rolling Mill plant.

At a recent meeting the board of directors of the Louisville Bolt & Iron Co., decided to erect and operate a plant for the manufacture of bar iron. Ground will be broken immediately and it is the intention to operate by April 1.

The Beaver Dam Malleable Iron Co., Beaver Dam, Wis., has recently equipped its plant with a chemical labratory, which has been placed in charge of F. G. Coffeen, formerly for a number of years connected with the Deering Harvester Company.

A LEADER IN LAKE SUPERIOR IRON MINING.

With the departure from the mining field of the lake region of Mr. D. H. Bacon, president of the Minnesota Iron Co., it is interesting to glance at the changes that have been concurrent with Mr. Bacon's connection with mining in Minnesota, and to note his own career to some extent.

Mr. Bacon is a man of 50 years of age, in the prime of life, and in the full maturity of judgment. He goes from the Lake Superior field to the chairmanship of the Tennessee Coal, Iron & Railway Co., with a broad grasp of affairs, an experience

DON H. BACON.

of years in mining and the execution of large undertakings, and with a knowledge derived from opportunities it has been given few men to enjoy. In his new field he will have full charge of the business of a company whose activities are not alone in iron mining, or in any class of mining only, but in the manufacture of pig iron and coke, the selling and exporting of large quantities of both iron and coal, and in the manufacture of basic open-hearth steel products in quantity from Southern ores. The mining operations of the Tennessee

J. L. GREATSINGER.

company include 6,000,000 tons of iron ore and coal while in its manufacturing operations it sends out 650,000 tons of pig iron and twice as much coke, to which will soon be added 1,250 tons daily capacity in steel billets, rails, etc. The company has assets of $34,000,000.

Mr. Bacon first went to Minnesota in 1887, three years after mining had begun in that state, but his career there has been coincident with the industry, for it was in his first year, and by his initiative, that underground and business-like mining began. In the wonderful advance of Minnesota as a mining

state he has been in the front rank, and has led in the movement. To the spring of 1887 less than 600,000 tons of iron had been mined; now the total is 46,000,000 tons, and nearly half of all has been under Mr. Bacon's direction and supervision.

The development made by the mining company since 1887 has necessitated the extension of the subsidiary railway from a length of 97 miles to about 250, and the movement of the vast volume of freight furnished by this mining company has involved the expenditure of many millions in other extensions and improvements. It involved the change of 18 miles of road at a cost of more than $500,000; it resulted in the construction of one of the great fleets of ships on the lakes, with a capacity for delivering on Lake Erie 2,000,000 tons of freight in the brief lake season, and in the erection of large dock systems at Buffalo and Ashtabula, on Lake Erie.

When the Minnesota mine closed its season of 1886 it was found that it had cost about $2.25 to mine every ton of ore shipped. Mr. Bacon looked over the situation and told the directors that ore could be mined for $1.65 at once. The following year's operations did cost about $1.65, though an expensive change in methods was inaugurated. In no subsequent year has the cost sheet approached that figure, though the work of getting up a ton of ore has increased every season. Since the commencemnt of underground mining in Minnesota the company has gone to a depth of 950 feet. It has gone still deeper with the diamond drill. It has drilled the hill upon which its mines stand pretty thoroughly and has as complete and elaborate a series of records of the ground for a depth of 1,000 feet as is possible. The company is operating three shafts at its original, hard ore mine, and is mining a very desirable non-Bessemer ore.

When the Mesabi range came into prominence the Minnesota Iron Co. was early and prominently in the field. It has spent in the past few years, chiefly there, more than $3,000,000 in the acquirement of ore lands. Among its Mesabi properties is the great Fayal, and the Genoa, Elba and Auburn, as well as several idle properties and unopened deposits, in all of the utmost value and magnitude. At its various mines there were mined last year 2,900,000 tons of ore, more than any other company in the world, with the exception of the Oliver Iron Mining Co., which operates in all the five lake ranges. The present year its business is expected to be in excess of 3,000,000 tons.

The policy of the Minnesota Iron Co., under Mr. Bacon's guidance has been most altruistic and in many respects unique as to its employees. For the past five or six years it has averaged a force of about 1800 men. In all its history the company has never missed a payday and has invariably paid in cash. This, though at one time it gave a bonus of $700 to secure $7,000 currency, and at times it was impossible to get cash on the paper of the largest steel companies in the country, with the Minnesota's endorsement. During a short period in the winter of 1893-4 the company was obliged practically to close its works. It then retained all the married men for whom it could find employment, gave all free rent, free fuel, and assisted them in every way possible, though it like every other mining corporation in the northwest was about as badly off as the men. It has always paid the highest wages, and has never disputed valid claims of its men. It has never been troubled by labor unions, and has had but one strike, and that not over wages but on account of some unexpected church feast day.

Mr. Bacon was the first man to crush hard ores for furnaces. It had been the habit to ship chunks as large as could be handled. Up to 1895 furnacemen made no objection to the large pieces, in fact preferred them, but later decided that they required more fuel. Many supposed it would be impossible to crush the extremely hard ores of the Minnesota, but Mr. Bacon did it, and at such a cost that there was soon shown to be a positive saving in the crushing operation, by the elimination of hand sledging and by the possibility of loading the entire product by steam shovel. The crushing cost varies from 6 to 7 cents a ton for the entire product.

Mr. Bacon was born in 1850 in Bradford county, Pa., and in 1862 went west and located in Michigan. When 19 he became a telegraph operator for the Cleveland Mining Co., now the Cleveland-Cliffs, at Ishpeming. He studied the science of iron mining, then in its infancy in the state, and grew up with it. By successive steps as timekeeper, cashier and assistant superintendent, he reached the superintendency of the mine in 1880. In 1883, when Jay C. Morse retired, he became agent, or manager, for the mine,. That place he retained till 1887 when he went to Minnesota. There, while under engagement to manage the Minnesota properties, but before taking hold, he conducted the explorations of the Chicago & Minnesota Ore Co., at the spot from which the Chandler mine in the year following made its first shipments. Mr. Bacon's name will be associated most intimately with three of the great mines of the country, the Minnesota, Chandler and Fayal, and what better monument could any man have?

Both Mr. Bacon and his long-time coadjutor and now successor in the office of president Mr. J. L. Greatsinger, are standing refutations of the statement that nowadays there is no room for a man to rise. Both began at the bottom of the ladder each in his own line.

TRADE PUBLICATIONS.

Wood-Working Machinery.—The Jeffrey Mfg. Co., engineers, founders, and machinists, Columbus, O., have recently issued a special sawmill catalogue, No. 57. The company manufactures chain belting, conveyors, elevators, steel cable conveyors, carriers and labor-saving appliances for the saw, lumber and wood-working industries. The catalogue contains many illustrations made from photographs of machinery in actual use.

Rock Drills.—The new shops of the Canadian Rand Drill Co., Sherbrooke, Que., are described and illustrated in a pamphlet just issued. The company was organized ten years ago, and occupied floor space in a 60x40 ft. building on the Magog river, owned by the Jenckes Machine Co. When the latter company enlarged the Canadian Rand Drill Co. did likewise, retaining floor space with it. The increasing needs of the company have rendered necessary a separate plant. The main building is 84x199 2-3 ft. Ample railroad connections are provided. The machinery is up-to-date. The company manufactures rock drills and compressed air machinery.

Power Presses.—An illustrated catalogue and price list of Perkins power presses and tools, has been sent to the trade by the Perkins Machine Co., of Boston. The catalogue states that all the presses and other tools are built from entirely new patterns in which are embodied many new improvements, making them much larger and heavier than the old style.

Twist Drills.—The Cleveland Twist Drill Co., Cleveland, has issued a convenient desk calendar, which contains much useful information, and has memorandum blanks for every day in the year. Accompanying the calendar is an attractively bound pamphlet entitled, "Eleven Little Pictures." These are views of some of the rooms at the works of the company, among them being the general office, the dining room at noon, the circulating library room, and a part of the engine room. The company has been conspicuous for its efforts to provide for the greater comfort of its employes.

Calendars, Etc.—Among attractive calendars for 1901, recently received at this office, are those issued by the following concerns: The Marion Steam Shovel Co., Marion, O.; The Ohio Sand Co., Conneaut, O.; The George B. Sennett Co., Youngstown, O., manufacturers of machinery, castings and forgings; The Schill Bros.' Co., Crestline, O., manufacturers of furnaces and steel ranges; and The Clearfield Fire Brick Co., Ltd., Clearfield, Pa., manufacturers of fire brick and furnace blocks. The Washington Coal & Coke Co., Dawson, Pa., has put out a handy calendar and memorandum book. It is bound in cloth and is a flat octavo. One-half page is given to each day of the year 1901. The Michigan Malleable Iron Co., Detroit, Mich., greets its patrons with an art piece made by the new process of color photography.

Patterns.—The Gobeille Pattern Co., Cleveland, has sent a circular to stove founders calling attention to the forward movement in stove construction, in which sheet steel and planished iron are being so largely used as materials for plane surfaces and cylindrical parts. Accompanying the circular are several brief extracts from letters received by the company, expressing satisfaction with its patterns.

Reference Book.—R. L. Polk & Co., 238 Fourth Ave., Pittsburg, Pa., have published a little book of 93 pages, which they style a "Purchasing and Selling Agents' Reference Book of the Iron and Steel Interests." It contains a list of firms and corporations engaged in the production of iron and steel in the Pittsburg, Wheeling, Mahoning, Shenango, Cincinnati and Ironton districts, with the plant or plants operated, their location, equipment, etc., and a detailed list of their products. It is edited by B. H. Morwood and is well arranged.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market and Some of Their Wants:

The Howard Elastic Wheel Co. has been organized at Kalamazoo Mich., with a capital of $25,000, for the manufacture of a new elastic steel wheel said to possess many points of merit over the wooden wheel. R. V. Parsons is president of the company, Otis Baker, vice president, and W. R. Wilson, secretary and treasurer.

The J. W. Fiske Iron Works of Red Bank, N. J., has been incorporated with a capital of $100,000. Joseph W. Fiske and Applegate & Hope are named as the incorporators.

The Globe Pattern Co., of Indianapolis, Ind., has been incorporated with a capital of $25,000. G. S. Black, W. T. Weisenborn and G. P. A. Weisenborn are the incorporators.

The Hutchinson Lock Mfg. Co. of Bourbon, Ind., has been incorporated with a capital of $10,000. Robert W. Hutchinson, Edgar Hayslett and Arthur C. Probert are the incorporators.

The Murray Co., of Dallas, Tex., has been incorporated with a capital of $300,000 for the purpose of operating a foundry and machine shop for the manufacture and repair of cotton gins and compress machinery. J. H. McDonough, F. J. Baker, A. A. Vardell, Arthur R. Marsh and G. W. Davenport are the incorporators.

The John Illingworth Steel Co. of Newark, N. J., has been capitalized at $30,000. John Illingworth and Elwood C. Harris are named as the incorporators.

The Eddy Valve Co., of Waterford, N. Y., has been incorporated with a capital of $50,000 to manufacture iron and brass castings. Thomas A. and John Knickerbocker and H. C. Rogers are the incorporators.

The Manville Covering Co., Milwaukee, Wis., will erect three two and three-story buildings, 50x150 ft. and 40x100 ft., to cost $20,000. The company will be in the market for four boilers, a 100 h. p. engine, 10 separators, 6 compressors, of 500 h. p., to cost about $25,000. Magnesium, mineral wool and other specialties will be manufactured.

Chas. Bates, architect for the new plant that the Hussey Mower & Implement Co. is to erect in Sandusky, O., which was noted recently in these columns, wishes to correspond with firms interested in cupola construction, slating, fireproof shutters, malleable ovens, etc. Estimated cost, $27,000.

The Leetonia Boiler Co., Leetonia, O., lately organized, has purchased the plant of and succeeded Woodward Bros., in the manufacture of boilers, tanks, stacks, and all kinds of sheet and structural work. The new company will enlarge and improve its plant and invites correspondence.

The Hanson & Tunelius Co., of Chicago, has been incorporated with a capital of $10,000. The new concern will manufacture machinery, tools, etc. Charles M. Hanson, C. E. Tunelius and C. O. Hanson are the incorporators.

Fires and Accidents:—

The plant of the Bellaire Stamping Co., at Harvey, Ill., was totally destroyed by fire December 31, causing a loss of over $400,000. Insurance to the amount of $307,000 was carried. The company moved to Harvey from Bellaire, O., ten years ago, and built a plant costing $75,000, which was destroyed by fire six years ago, and was then rebuilt. The plant occupied a four-story brick building, 200 by 400 feet in size. The cause of the fire is not known, but it started in the furnace room, and the rapid spread of the flames is attributed to the large quantities of oils and enamels carried in stock by the company for use in its manufacture of stamped and enameled ware.

The office and pattern shop of the Stoner Iron Works at Los Angeles, Cal., were damaged by fire to the extent of $1,600 last week.

The immense plant of the Bellaire Stamping Co. at Harvey, Ill., was almost totally destroyed by fire last week. The loss is estimated at $400,000, partially covered by insurance.

The car shops of the Virginia & Southern railroad were burned on Jan. 5, entailing a loss of $75,000 to $100,000.

The plant of the American Steel Casting Co. at Sharon, Pa., was damaged to the extent of $25,000 by fire last week. Partially covered by insurance.

The pattern department of the S. Jarvis Adams Co., of Pittsburg, was destroyed by fire last week entailing a loss of $75,000.

The Nes Chain Works of the Standard Chain Co., located at York, Pa., was damaged to the extent of $15,000 by fire last week. The loss is fully covered by insurance.

Fire damaged the wire plant of Clyde & Coleman, Rome, N. Y., to the extent of $5,000. Insured.

The Riker Motor Vehicle Works, Elizabethport, N. J., were partially destroyed by fire on Dec. 29. The loss is reported at $50,000.

New Construction:—

The Bessemer Gas Engine Co., of Grove City, Pa., has completed the foundation for another building, 60x110 feet. A small addition, 60x32 feet, will also be erected.

David C. Schuler & Co., of Philadelphia, will erect a $4,000 addition to their machine shop.

The City & Suburban Homes Co. Ltd., has sold to Detroit Valve & Washer Co., Detroit, Mich., a factory site on the west side of Foundry St., just south of Michigan Ave. The tract is a flat iron having a frontage on Foundry St. of 100 feet, and a depth of 130 feet. This company has been donig business for about three years, and the purchase of this property was found necessary to establish a plant which will enable it to keep up with orders. A brick building 55x100 and three stories high will be erected immediately.

The Warren City Boiler Works, Warren, O., has commenced work on a 135x150 ft. addition to its plant, which will be completed in about 60 days. This is rendered necessary by the crowded condition of the present plant.

The Republic Iron & Steel Co. has awarded contracts for the construction of another billet mill in connection with the one recently completed at Youngstown. It will break billets down from 4x4 to an inch and a half square.

The Hassell Iron Co., of Colorado Springs, Colo., will shortly erect a boiler shop.

The Hunt Air Brake Co. of New Kensington, Pa., has commenced work on a 60x160-ft. building to be used as a foundry. It will be equipped with a cupola and foundry appliances.

The Ball & Wood Engine Co. of Elizabeth, N. J., will enlarge their present plant to about double its present capacity within the very near future.

The St. Paul Foundry Co., of St. Paul, Minn., will erect a $6,000 office building.

The Westmoreland Steel Co., whose plant is located south of Greensburg, Pa., will enlarge their plant by a 40x60 foot addition.

The Sodom shops of the B. & O., which were burned recently, are being rebuilt. The main building will be 45x120 ft., and will contain the erecting, turning, carpenter and boiler shops. New and up-to-date machinery will be installed at a cost of about $20,000. This will include one double-head tire lathe, one vertical 37-inch boring drill, two drillpresses, two 12-inch lathes, one 24-inch lathe, one 36-inch lathe, one 36-inch planer, one hydraulic wheel press, one bolt cutter, one slotting machine, one stationary engine and two stationary boilers.

The C. A. Furbush Machine Co., Philadelphia, will erect a large stone and brick addition to its plant.

In addition to building a steel plant covering several acres, the Reading Iron Co., Reading, will erect one of the largest and best equipped skelp mills in the world. It will treble the capacity of the company's plant.

The Union Machine Co., Nashville, Tenn., will rebuild its foundry burned recently.

The Ashboro Wood and Iron Works, Ashboro, N. C., whose plant was burned, has incorporated, with capital stock of $6,000, to conduct a general foundry business.

The Pittsburg District:—

The W. H. Haws Fire Brick Co., Johnstown, Pa., announces under date of Jan. 2, 1901, that the differences heretofore existing between the Harbison & Walker Co., Pittsburg, and the W. H. Haws Fire Brick Co. have been adjusted, the members of the Harbison & Walker Co. having come into possession of all the stock of the W. H. Haws Fire Brick Co. S. C.

Walker was elected president, succeeding Scott Dibert; B. C. Youngman, secretary, and William Walker, treasurer, succeeding John H. Waters. The main office of the company has been removed from Johnstown, Pa., to Room 1405, Park Building, Pittsburg.

The American Tin Plate Co. has issued orders for starting the New Kensington, Pa., plant on January 14. It is a 7-mill plant and has been idle since last June. The Monongahela plant on the South Side, Pittsburg, is still idle and will probably remain so for some time as all the heavy stock has been removed to New Kensington.

On Saturday, Jan. 5, the Howard Axle Works of the Carnegie Steel Co., at West Homestead, broke all previous records in the output of axles. In 12 hours 64 axles, each weighing 990 pounds, were produced. The axles were all broken down from open-hearth billets into axle form in the rolling mill and forged under the hammer after which they were finished in the lathes.

Director Wilson, of the Pittsburg department of public works, will advertise in a few days for bids for two pairs of new engines for the Brilliant pumping station. The engines will have a pumping capacity of about 25,000,000 gallons a day, according to the specifications. Bids have been asked for several times, but each time the director believed that the bids were too high.

Henry F. Loud, general manager of the British Westinghouse plant, while in Pittsburg last week sent out specifications for bids for about $500,000 worth of machine tools for the large plant that the Westinghouse interests are erecting in Manchester, Eng. Specifications were sent to manufacturers in the United States, Germany and England. The contracts for the engines for the plant have already been awarded to the Westinghouse Electric & Mfg. Co. They are to be of 1,200-h. p. each, two in number and of the Corliss type. The buildings for the new plant in England will cover about 26 acres and the capacity will be about 80 per cent of that of the present plant at East Pittsburg. The main building will be 900 feet long and 427 feet wide and will be divided into five bays.

The McClintic-Marshall Construction Co., of Pittsburg, has been awarded the contract for erecting the steel superstructure of the Marshall Field building at Chicago. The amount of structural shapes required is estimated at 8,000 tons.

The puddling department of the Republic Iron Works, of the National Tube Co., on the South Side, Pittsburg, resumed operations this week. The 13-inch mill of this plant resumed operations last week.

J. D. Lyon, who has had charge of the sales of the Otto gas engine for Somers, Fitler & Clarke, of Pittsburg, for several years past, and F. H. McKinnie have organized a co-partnership known as J. D. Lyon & Co., merchant engineers, with offices in the *Chronicle-Telegraph* building, Pittsburg. In addition to dealing in a general line of machinery the new concern will act as the sole Pittsburg selling agents for the Miller Improved Gas Engine Co., of Springfield, O.

Work was started this week on the dismantling of 12 puddle furnaces of the Sable Iron Works of Zug & Co., to make room for the two-mill sheet plant that will shortly be installed.

The strike of the structural iron and steel workers of the Pittsburg district was of short duration, their demands having already been conceded by nearly all of the construction companies affected by the walk-out. Only three concerns have thus far failed to sign the scale and in all probability they will do so shortly. All large work has again been resumed.

The Firth-Stirling Steel Co. has purchased a tract of 700 feet frontage adjoining their works at Demmler, Pa., upon which a large addition will be erected to the tool steel department.

Vice President Reese, of the Amalgamated Association of Iron, Steel and Tin Workers of America, has issued a call for a district conference to be held in Pittsburg Sunday, January 13. The meeting is called to consider the calling of a district gathering in the near future.

The United States Mfg. Co., of Pittsburg, has placed an order with J. D. Lyon & Co., mechanical engineers, for a 100-h. p. Miller improved gas engine.

The W. J. Carlin Co., of Pittsburg, has awarded a contract to the Dickson Locomotive Works for 27 locomotives. The heavy demands for engines and the fact that orders for 20 pairs of stationary engines of 200-h. p. each have been taken by the Carlin Locomotive Works, prevented the manufacture of the locomotives in Pittsburg.

The Harbison & Walker Co., of Pittsburg, manufacturer of fire brick, has purchased 5,000 acres of mountain land in Blair county, Pa. The land abounds in ganister ore which will be utilized in the manufacture of fire brick at the plants of this company.

The Rankin plant of the American Steel & Wire Co., which was forced to suspend operations on account of a recent fire, resumed last week in full.

The Riter-Conley Mfg. Co., of Pittsburg, has been awarded the contract for the rebuilding of the melting and molding departments of the American Steel Casting Co.'s plant at Sharon, Pa., recently destroyed by fire. The building will be 150x125 feet.

The National Malleable Casting Co. will increase the size of its Sharon, Pa., plant by the erection of an addition to its steel foundry. It will be 200x60 feet and will furnish employment to about 100 additional hands.

Ground was broken last week at Duquesne for a new 14-inch blooming mill for the Carnegie Steel Co. It will be located north of the 40-inch mill. The building will be erected by the Carnegie Steel Co.

Chicago District and Northwest:—

The Robert Aitchison Perforated Metal Co., 303 Dearborn St., Chicago, has closed a contract with one of the large thresher machinery makers of the Northwest for their season's supply of perforated metals, and has also just received an order or over 60,000 square feet of perforated steel for malt machinery. The company states that business is very good and the outlook for the future most excellent.

Under date of Jan. 1, a notice, bearing the signatures of D. S. Wegg, president of the Railroad Supply Co., and C. F. Quincy, president of the Q. & C. Co., has been issued, stating that henceforth these two companies will be operated as one company, under the name of the Railway Supply Co. D. S. Wegg is chairman of the board, and C. F. Quincy is president. The general offices of the company will be in the Bedford Bldg, Chicago, and the New York office at 100 Liberty st.

The Andrews Wire Works, Rockford, Ill., will be enlarged in the near future, the contract having been let for plans for an addition 50 by 136 feet in size. The South Halsted Street Iron Works, S. Halsted St., Chicago, will be removed in the near future to North Chicago. The company now employs 450 men, and will have a still larger force in its new quarters.

James B. Clow & Sons, of Chicago, manufacturers of cast iron pipe and fittings, steam goods, heating apparatus, plumbing goods, sanitary specialties, etc., have purchased the entire stock, fixtures and manufacturing plant of Walcott-Webster Mfg. Co., located at 15 N. Clinton St., Chicago. The Walcott-Webster plant consists of a completely equipped modern brass foundry, and finishing works, nickel plating works, marble mill, slate and soap stone works, tool, pattern and cabinet shops, all of which, extensively enlarged and improved, will be operated in the present location by James B. Clow & Sons, under the personal management of William M. Webster, president of the former company. The stock will be removed to the Clow warehouse and show rooms at Lake and Franklin streets.

The office of Forster, Waterbury & Co., manufacturers of malleable and gray iron castings and specialties, has been removed from 355 Dearborn St., Chicago, to the works at Franklin Park, Ill.

At a meeting of stockholders of the Palmer Steel & Iron Co. at the offices of the company, the Rookery, Chicago, it was decided to change the name of the company to the American Rolling Mill Co. The officers were all re-elected for the ensuing year. They are J. H. Palmer, president, and W. J. Moody, secretary and treasurer. The bar mills of the company at Muncie, Ind., are operating fully.

Plans are being prepared for a foundry to be built at 1155 S. Paulina St., Chicago, for the Franklin Foundry Co., to take the place of the old plant, recently burned. It will be one story, 66 by 120 feet in size, of heavy mill construction, costing about $4,000.

The Hammond Steel & Iron Co., a newly organized company, has taken possession of the old plant of the Lakeside

Saving due to Cochrane Heaters.

Do you realize what the saving due to feed-water heating means? Suppose you have a 200 H. P. plant, with a single cylinder non-condensing engine that will use about four tons of coal per horse power per hour. If you run it for three days of ten hours each, and pay three dollars per ton for your coal, including the cost of handling it, your fuel bill at the end of the year will foot up to $3,600

Now, if the average temperature throughout the year of the water supply used in your boilers is 60° F. (feeding with live steam injectors is about the same as feeding with cold water, as far as fuel is concerned) you can save about 18 per cent of that $3,600, or $648! That is more than twice the cost of a **Cochrane Heater** for a 200 H. P. boiler plant. In a few months the heater would pay for itself and after that the savings would go towards increasing the profits of your business.

There is no more paying investment about a steam plant than a **Cochrane Feed-Water Heater.**

Saving in fuel is only one of its advantages. Others are mentioned in our catalogue.

HARRISON SAFETY BOILER WORKS, Clearfield & 17th Streets, PHILADELPHIA, PA.

Nail Co., at Hammond, Ind., under a lease for five years, and will operate a bar iron plant with a capacity of 100 to 150 tons per day in it. The company has a capital stock of $300,000. John D. Briggs is president, and A. F. Seeberger is treasurer.

Plans have been made and figures are being taken for a new foundry plant for John Ramsay, 12 Ohio St., Chicago. The new foundry will be located on Twenty-first St., near Jefferson St., Chicago. It will be 200 by 100 feet in size, of brick and iron construction, and will have complete modern foundry equipment.

The Winslow Bros. Elevator Co., recently formed in Chicago, has purchased the business and equipment of the Excelsior Iron Works, 100 Clinton St., and has taken a five years' lease on the building at that number. The company will manufacture high grade freight and passenger elevators.

Cassius M. Paine, of Milwaukee, Wis., has in hand the organization of the Brown Corliss Engine Co., which has been incorporated in that city with a capital stock of $1,000,000 for the manufacture of engines of the Corliss type, ranging from 100 to 5,000 horse power. Subscriptions for the preferred stock of the new company are now being solicited, payments to be called for after the organization is perfected. The company will build a plant costing approximately $325,000. It is proposed to issue preferred stock to the amount of $500,000, which will leave a working capital in the treasury of the company of $175,000. It is expected that the active management of the business will be in the hands of T. W. Phillips, of Providence, R. I., as president and in charge of the sales department; Walter F. Brown, of Milwaukee, Wis., as vice-president and superintendent of the plant, and Charles Rhode of Milwaukee, as treasurer and business manager.

General Industrial Notes:—

The Asbestine Mfg. Co., Windber, Pa., was recently organized with capital at $10,000, to manufacture asbestine. Six large brick furnaces are in use and turn out daily 400 slabs of asbestine, which is used as a stove lining. Another use is for plastering bricks around boilers. It is in use at the company's plant and gives satisfaction, being very durable.

The Pennsylvania Malleable Co. has removed its offices from the Park building, Pittsburg, to its works at McKees Rocks.

The firm of Robert Ligget & Co., iron and steel merchants of Philadelphia, Pa., has been dissolved, and the business will be continued at 135 and 137 North Thirteenth Street, under the same name by Messrs. Samuel, Craig N., George S. and Howard B. Ligget.

The Falk Mfg. Co., Milwaukee, Wis., has taken a contract from the Grosse Berliner Strassenbahn Gesellschaft, Berlin, to weld all the rails of that company in Berlin.

The LaBelle tin mill of the American Tin Plate Co., located at Wheeling, W. Va., resumed operations this week after an idleness of several months.

A. Leschen & Sons' Rope Co., whose main office is at 920-922 N. First St., St. Louis, Mo., has just arranged to open a New York office and warehouse at 92 Centre St., corner of Leonard St., New York City, where will be carried a full and complete stock of wire rope and be prepared to make prompt shipments. This house is the owner and manufacturer of the Leschen Co.'s patent aerial wire rope tramway, an outfit which is used for the transportation of ore, rock, dirt, timber, etc., not only over mountainous, but also over level country. Among several of the principal features of this type of tramway is the fact that it loads and unloads automatically, can be operated by one man, is inexpensive to maintain, and is a tramway which has the greater possible capacity.

The Chicago Iron & Metal Co. has recently established an agency at Houston, Tex., for the handling of all kinds of scrap metals.

William H. Staake and John M. Shimer have been appointed receivers of the Elmira Steel Co., of Elmira, N. Y. The company was controlled by C. R. Baird, of Philadelphia.

The following organization of the Bradford Steel Co., Bradford, Pa., was recently perfected at a meeting of the stockholders: Directors, D. Emery, E. P. Whitcomb, J. Fischer, S. A.

Pig Iron

Made in Alabama by the SLOSS-SHEFFIELD STEEL & IRON COMPANY. . . .

FOUR FIRST CLASS BRANDS.

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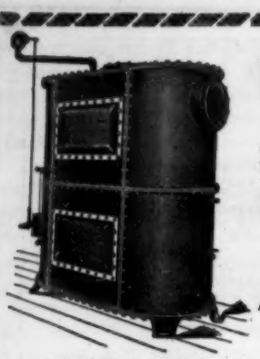

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FEED WATER HEATERS

Cut herewith illustrates Stillwell's latest design. Made entirely of cast iron. Saves fuel and filters the feed water for steam boilers. Use only exhaust steam.

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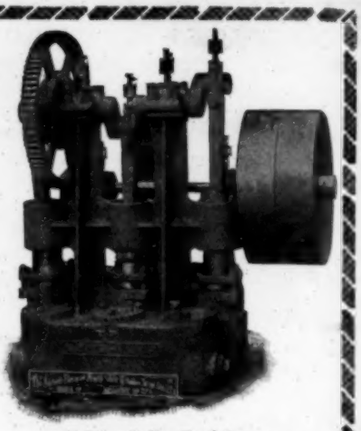


Triplex Boiler Feed Pump.

Holbrook, F. E. Durfey, T. H. Kennedy and J. E. Cochran; Officers—D. Emery. president; E. P. Whitcomb, vice president; J. Fischer, secretary and treasurer.

The business of the Boothe Mfg. Co., of Los Angeles, Cal., has been transferred to the Pacific Coast Mfg. Co. and the wholesale machinery business will be continued on a more extensive scale by the new organization. Valentine Peyton is the president of the purchasing company; J. A. Haskett, of Kansas City, vice president and manager, and Arthur Hawes, secretary and treasurer. The new concern is capitalized at $100,000.

The firm of Barclay W. Cotton & Co., of Philadelphia, Pa., iron and steel merchants, has been dissolved by mutual consent, Lincoln W. Burger retiring. Barclay W. Cotton will continue the business at the present address at 418 Walnut street.

The Sloss-Sheffeld Iron & Steel Co. has just completed the shipment of 900 tons of high grade foundry iron to Manchester, Eng.

Furnace No. 2 of the Republic Iron & Steel Co., at Thomas, Ala., has been put in blast. Work on the new blast furnace at that place is progressing rapidly.

The capital stock of the Fulton Iron & Engine Co., of Detroit, Mich., has been increased from $100,000 to $200,000.

The Trump Mfg. Co., of Springfield, O., has received an order for three water wheels or delivery in Italy. Each wheel is to be of 350 h. p. capacity.

The new plant of the Babcock & Wilcox Boiler Co., at Bayonne, N. J., was placed in operation with the advent of the new year.

All of the furnaces of the Lackawanna Iron & Steel Co., at Cornwall and West Lebanon, Pa., are now in operation after an idleness of about six months.

The plant of the American Foundry & Machine Co., at Bowling Green, O., has been purchased by E. P. Mull and J. G. Hickox, of Toledo, O. The new concern will be known as the Hickox-Mull Mfg. Co.

The *Railway Gazette* of Jan. 4, under new locomotive and car building, notes the following: The Baldwin Locomotive Works will build 18 locomotives for the Pere Marquette, and 4 for the Grand Rapids & Indiana; the Brooks Locomotive Works, 10 locomotives for the Hocking Valley, and 60 for the Chicago, Rock Island & Pacific; the Dickson Locomotive Works, 23 locomotives for the W. J. Carlin Co., Pittsburg, instead of Thomas Carlin's Sons Co., Allegheny, as reported; The International Power Co., 15 locomotives for the Louisville & Nashville; the Pittsburg Locomotive, 39 locomotives for the Illinois Central. The American Car & Foundry Co. has orders for 500 box cars for the Philadelphia & Reading; the Pullman Co., 2,600 coal cars for the Hocking Valley; the Haskell & Barker Co., 1,000 box cars for the Chicago & Northwestern. The Northern Pacific has received bids on about 5,100 freight cars. The Chicago, Milwaukee & St. Paul, it is said, will build 250 refrigerator cars in its own shops. Fox Bros. & Co., New York, are figuring on 100 flat and 50 box cars for a railroad in Porto Rico.

The Republic Iron & Steel Co. will blow in its No. 2 furnace at Birmingham, Ala., which has been out for repairs; No. 3 furnace, now building, will be completed early next summer. The company has opened up mines at Republic, with daily capacity of 1,000 tons of coal, to be increased soon to 2,500 tons; present capacity of Sayreton mines is 1,000 tons per day, and this will be increased soon to 1,500 tons.

The furnace of the Youngstown Steel Co., Youngstown, O., was blown in December 27. This furnace blows metal for the special washed metal plant, the exclusive product of the company. It has been relined and otherwise improved.

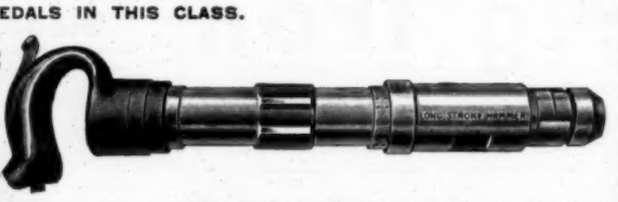
The new furnace of the Canada Iron Furnace Co., at Midland, Georgian Bay, Ont., has been blown in. It has a daily capacity of 150 tons. The directors of the company are: P.

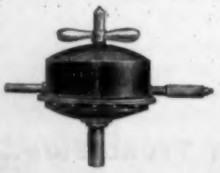
Paris Exposition, 1900, confers Highest Award and Two Gold Medals.

ONLY GOLD MEDALS IN THIS CLASS.

CHICAGO PNEUMATIC TOOL CO.,

632-640 Monadnock Bldg., CHICAGO, ILL.





BRANCH OFFICES:

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Pneumatic Riveters, Hoists, Cranes, Jacks, Painting Machines, Motors for every use, Casting Cleaners, etc.

Hammers		Drills	
For	Chipping Castings.	For	Mines.
"	Calking.		
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MOUNT SAVAGE FIRE BRICK.

UNION MINING CO.

ESTABLISHED 1841.
CAPACITY,
60,000 PER DAY; 18,000,000 PER YEAR.
The First Manufactory of Its Kind in the United States.

Proprietors of the
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They have fewer parts than any other in the market.
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Pittsburg is becoming known as a banking and money center as well as a manufacturing point. Its Stock Exchange is the market for most of the iron and steel securities.

Robert C. Hall,
Member of the Pittsburg Stock Exchange,
will be pleased to secure information or make transactions in these stocks at any time. Phone 3613, or 331 Fourth Ave., PITTSBURG, PA.

H. Griffin and the Hon. T. Guilford Smith, of Buffalo, N. Y.; George E. Drummond, James T. McCaul, Thomas T. Drummond and A. F. Gault, of Montreal; George Gudewell, of New York; F. H. Clergue, of Sault Ste Marie, Ont., and E. V. Douglas, of Philadelphia.

The Pennsylvania Steel Co., Philadelphia, has just completed the highest bridge in the world. This is the Gokteik viaduct in Burmah, and is part of a railroad constructed by the British from Rangoon, Burmah, through Mandalay into China. It is 2,260 feet long and 320 feet high over the deepest part of the gorge. It is built entirely of steel, having 16 supports of lattice steel work 140 feet from center to center. The supports vary in height from 20 feet to 320 feet and the base of the highest covers 135 feet on each side. About 40,000 tons of steel were used, shipments being made in July, August and September of last year. Work was begun in January and finished in November, about 40 skilled American mechanics being sent out by the company. The contract was taken by the company in competition with the whole world.

The output of steel roofing manufactured by the Berger Co., Kanneberg, Canton Steel Roofing Co. and J. H. Eller, all of Canton, O., aggregated about 15,000 tons in 1900. The foreign trade in steel roofing is expanding constantly.

Otis, Bonnell & Co., iron and steel merchants, Cleveland, are distributing to the trade a "Congress minor reminder," of vest pocket size, leather bound, containing valuable memoranda.

A tasteful art calendar has been sent out with compliments of the Superior Charcoal Iron Co. of Grand Rapids, Mich. It contains six leaves joined at the top by a ribbon, each leaf having a lithograph, which is designated as a "20th Century American Beauty."

The New Era Iron Works Co., Dayton, O., manufacturer of the New Era gas engine, will install a number of new milling machines, twist lathes, automatic tools, etc. Though this plant was newly equipped only a year ago, the great demand for its engines compels the company to increase its facilities.

The Pressed Steel Car Co., of Pittsburg, has commenced suit in the United States Circuit Court at St. Paul, Minn., against the Eastern Railroad Company of Minnesota, on a

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123-125 Water Street,
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For Blast Furnaces, Docks and Mines,
MINING MACHINERY,
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Regenerative Gas Furnaces and Water Seal Gas Producers.
Producer Gas under Tubular Boilers, saving 20 per cent in fuel. NO SMOKE.

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Victor Boiler and Structural Rivets
FINISH UNEXCELLED. QUALITY HIGHEST STANDARD.
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KENTUCKY FIRE BRICK WORKS, PORTSMOUTH, O.
HIGH GRADE FIRE BRICK
BEST BLAST FURNACE & ROLLING MILL BRICK
STEEL WORKS BRICK.
FIREBRICK, KY.

contract for steel cars, the purchase price of which was $350,000. The amount demanded as a balance alleged to be due is $135,000. The contention of the railroad company is that delivery of the cars was delayed and that damages to the amount due have been incurred. On the other hand, the Pressed Steel Car Co. alleges that the cars were delivered at the specified time in the contract.

Increasing Use of Blast Furnace Gas Engines.

The progress which the utilization of blast furnace gases in the production of power is making in Europe may be estimated from the statement that the Cockerill Co. and other companies licensed to use its plans have under construction at the present time engines aggregating a total of 35,000 h. p. Some of these are blowing engines, but the majority are intended to operate dynamos and furnish electricity for light and power. A list of plants already in operation given by a German contemporary recently includes nine in Germany, one in Russia and one in Great Britain, besides the Cockerill plant at Seraing, in Belgium. The largest of these plants is at Hoerde, in Westphalia, where two engines of 600 h. p. each operate the blowers and two of 1,000 h. p. each run dynamos and furnish electricity which is used in the manufacture of calcium carbide. The Russian plant recently erected at the Toula furnaces, in the Moscow District, has 2,400 h. p., including three engines of 600 h. p. each for blowing and three of 200 h. p. each which operate the electric plant. The plants now in operation at Seraing and at Differdingen in Luxemburg are each rated at 2,000 h. p.; and both are to be increased in Size.—[Engineering and Mining Journal.

FOR CAR WORK

and all malleable work there are no stronger or more satisfactory irons than

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Opinions on Thos. D. West's

"METALLURGY OF CAST IRON."

James M. Swank, author of "Iron in All Ages," and editor of the *Bulletin* of the American Iron & Steel Association, in reviewing "Metallurgy of Cast Iron" says it is "one of the most valuable publications relating to the manufacture of iron castings that has ever, to our knowledge, been issued in this or any othe country."

The *Engneering Magazine* (New York) in reviewing this book says: "The author of tnis treatise is doubtless the highest authority in the United States upon the metallurgy of cast iron. He has, in our opinion, done more to advance the art of iron founding than any other man of the period."

C. F. Blakesly, general manager Du Quoin Iron Works Co., Du Quoin, Ill.: "'Metallurgy of Cast Iron' should be in the hands of every progressive foundryman, and, in fact, every one who has to do with castings."

Chas. S. Booth, president the Oakland Iron Works, Oakland, Cal., says: "I consider 'Metallurgy of Cast Iron' the most complete, comprehensive and exhaustive work yet issued. I have found Part III., which treats on the science of mixing and melting iron, especially valuable, and do not think that a manager or owner of any foundry can make better use of his time and money than to purchase a copy of this work and study it carefully, and then apply the knowledge derived therefrom to the practical operations of his business."

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Tools for Boiler Shops, Machine Shops and general iron manufacturing industries.

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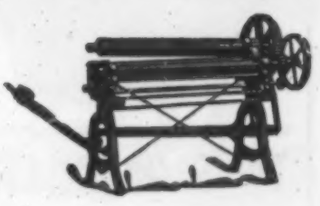

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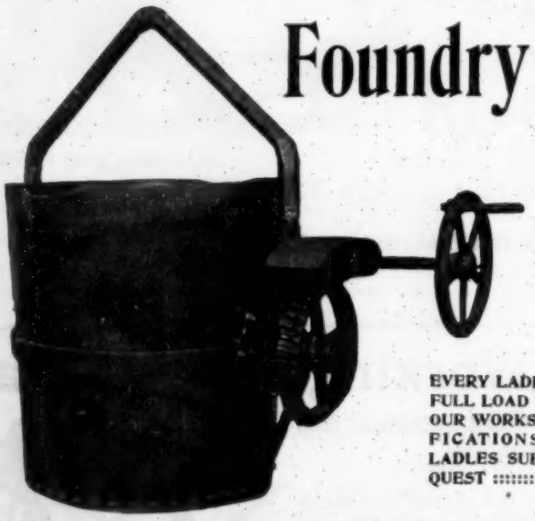

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South Bound.			Central Standard. Lorain Branch		North Bound	
15	13	11		12	14	16
P.M.	P.M.	A.M.	LV AR.	A.M.	A.M.	P.M.
4:25	1:05	7:05	Lorain	9:10	11:30	6:37
4:40	1:20	7:20	Elyria	8:54	11:16	6:23
4:56	1:38	7:41	Grafton	8:35	10:59	6:05
5:15	1:57	8:00	Lester	8:15	10:41	5:47
5	3	1	Main Line	2	4	6
4:40	1:00	7:10	Cleveland	9:10	11:40	6:40
4:54	1:16	7:24	Brooklyn	8:54	11:24	6:26
5:45	2:02	8:14	Lester	8:10	10:40	5:40
5:56	2:11	8:23	Medina	7:55	10:30	5:26
6:19	2:30	8:43	Seville	7:33	10:10	5:05
6:26	2:36	8:49	Sterling	7:27	10:04	4:59
6:48	2:58	9:11	Warwick	7:05	9:42	4:35
6:56	3:05	9:18	Canal Fulton	6:58	9:35	4:28
7:16	3:23	9:39	Massillon	6:40	9:18	4:11
7:31	3:40	9:58	Justus	6:24	9:03	3:55
8:01	4:11	10:26	Canal Dover	5:55	8:34	3:26
8:08	4:18	10:33	New Philade	5:48	8:27	3:18
8:25	4:35	10:50	Uhrichsville	5:30	8:10	3:00
	4:50	11:15	D. " A.	.....	8:10	3:00
	6:50	1:15	Bridgeport	.....	6:10	1:00
	7:05	.....	Bellaire	.....	5:55	.....
	P.M.	P.M.	AR. LV.	A.M.	A.M.	P.M.

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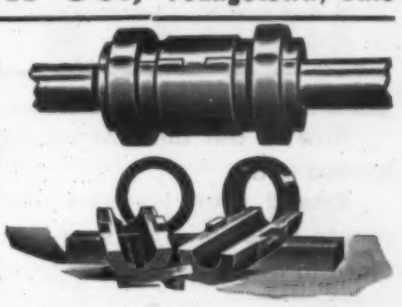
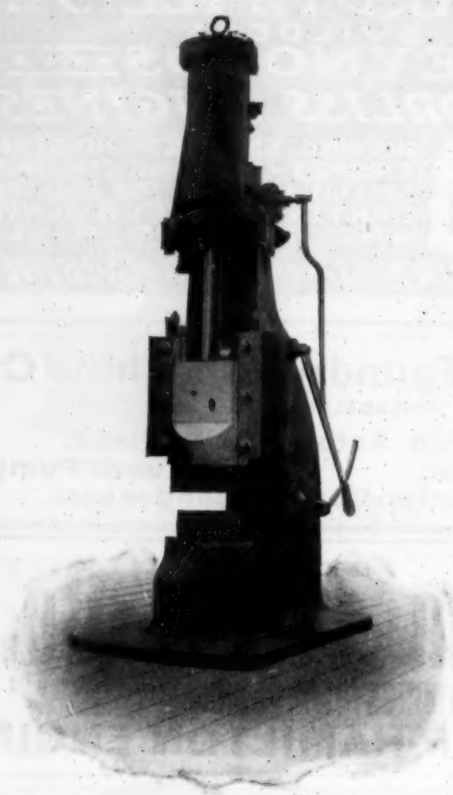
Foundry contracts solicited for duplicate castings, from 10 lbs. to 5 tons each.





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Sizes	Stroke.	Usual Die Face.	C of Die to Frame.	Steam.	Exhaust.
200 lbs.	16	4 x 7	12½	1¼	2
250 "	16	4½ x 7	12½	1¼	2
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800 "	25	6 x 12½	20	2	2½
1000 "	28	6 x 13	22½	2½	3
1250 "	30	7 x 13	23½	2½	3
1500 "	33	7 x 14½	25	2½	3

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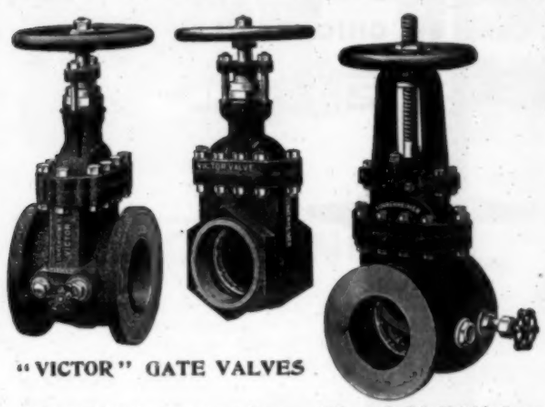

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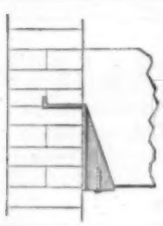

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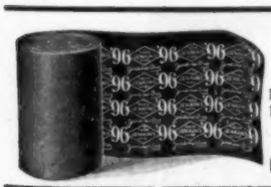

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Made from

PARSONS MANGANESE BRONZE

Cannot be excelled. Write for Particulars.

SOLE MAKERS

THE WILLIAM CRAMP & SONS'

Ship and Engine Building Company,

PHILADELPHIA, PA.

Northampton Emery Wheel Co.,

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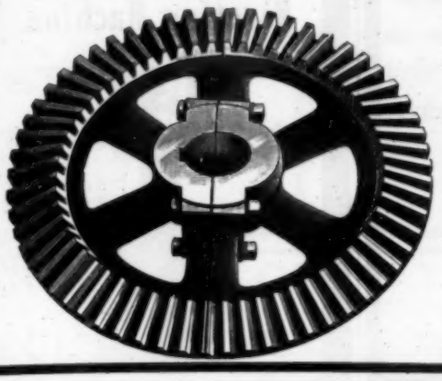

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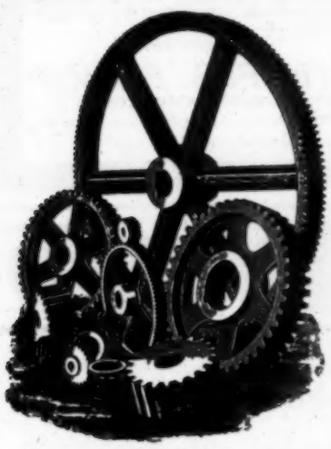

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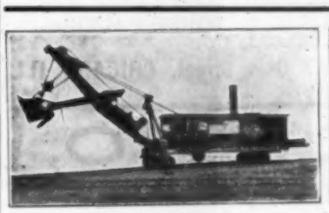

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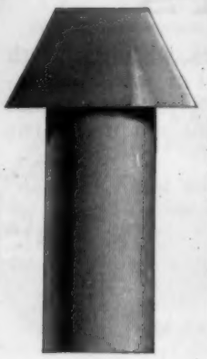

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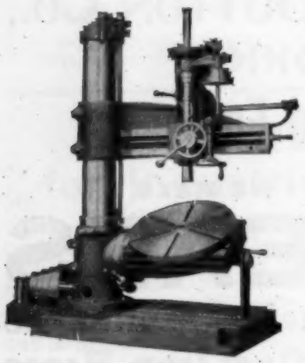

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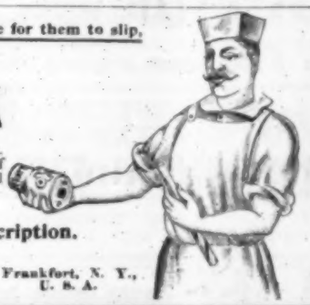

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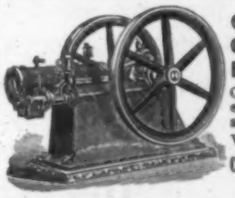

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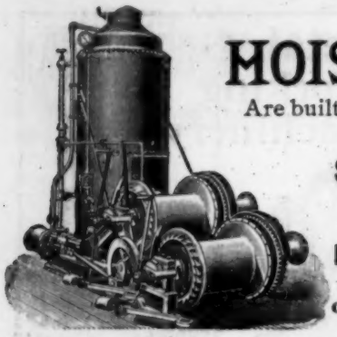

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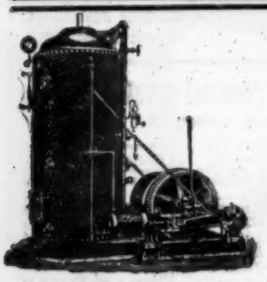

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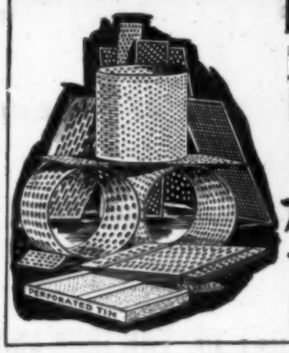

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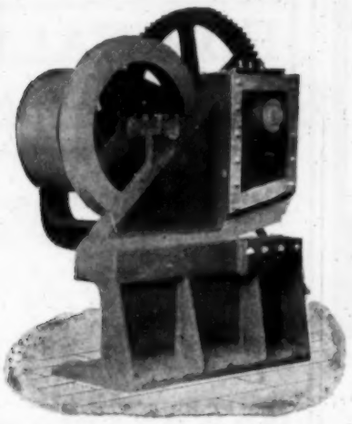

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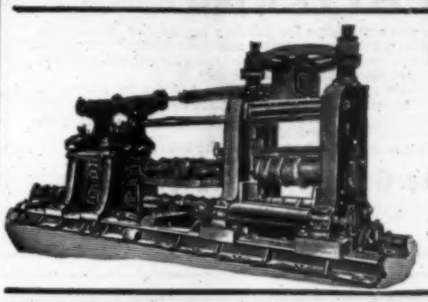

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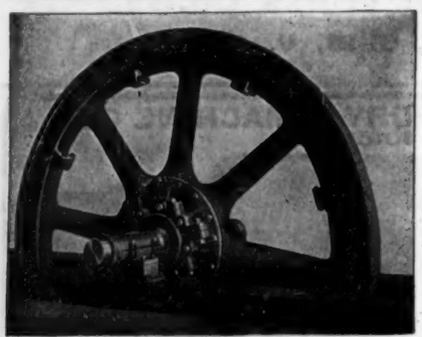

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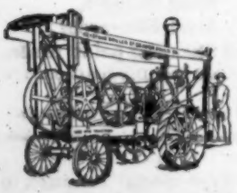

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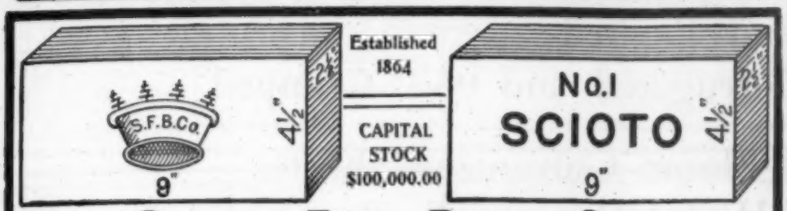

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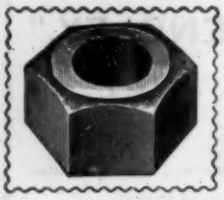

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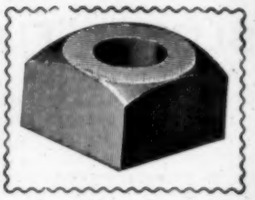

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F. A. Emmerton, Cleveland, O.
O. Texter, Cleveland, O.
The R. W. Hunt & Co., Chicago, Ill.
Grasselli Chemical Co., Cleveland, O.
Geo. C. Davis, Philadelphia, Pa.

CHILLED AND SAND ROLLS—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
Lorain Foundry Co., Lorain, O.
West Penn Foundry & Machine Co., Avonmore, Pa.
Frank-Kneeland Machine Co., Pittsburg, Pa.
A. Garrison Foundry Co., Pittsburg, Pa.
Canton Roll & Machine Co., Canton, O.

CHIPPING HAMMERS—
Cleveland Pneumatic Tool Co., Cleveland, O.
Chicago Pneumatic Tool Co., Chicago, Ill.

CHUCKS—
Pratt Chuck Co., Frankfort, N. Y.
Somers, Fitler & Clarke, Pittsburg, Pa.

COAL CUTTERS—
The Ingersoll-Sergeant Drill Co., New York.
Jeffrey Mfg. Co., Columbus, O.
Link Belt Machinery Co., Chicago, Ill.

COAL SCREENS—
Hendrick Mfg. Co., Carbondale, Pa.
Rob't Aitchinson Per. Metal Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Western Machinery & Supply Co., Chicago, Ill.

COAL AND COKE—
M. A. Hanna & Co., Cleveland, O.
Jerome Keeley & Co., Philadelphia, Pa.
Reed F. Blair & Co., Pittsburg, Pa.
Pilling & Crane, Philadelphia, Pa.
Pickand, Brown & Co., Chicago, Ill.
H. C. Frick Coke Co., Pittsburg, Pa.
McKeefrey & Co., Leetonia, O.
Pickands, Mather & Co., Cleveland, O.
J. H. Hillman & Son, Pittsburg, Pa.
Cherry Valley Iron Co., Pittsburg, Pa.
Bessemer Coke Co., Pittsburg, Pa.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Alabama Consolidated Coal & Iron Co., Birmingham, Ala.
A. M. Crane & Co., Chicago, Ill.
O'Gara, King & Co., Chicago, Ill.
The Rob't Field Co., Columbus, O.

COAL HANDLING MACHINERY—
The Atlas Car & Mfg. Co., Cleveland, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.

COAL MINING MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
Webster, Camp & Lane Machine Co., Akron, O.
Link Belt Machinery Co., Chicago, Ill.
A. Leschen & Sons Rope Co., St. Louis, Mo.

COLD SAWS—
J. R. Vandyck, New York City, N. Y.

COMPAROMETERS—
Vulcan Mfg. Co., Pittsburg, Pa.

COMPRESSION COUPLINGS—
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, O.

CONDENSERS—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

CONTRACTORS' SUPPLIES—
A. Leschen & Sons Rope Co., St. Louis, Mo.

CONVEYING MACHINERY—
A. Leschen & Sons Rope Co., St. Louis, Mo.
American Engineering Works, Chicago, Ill.

CONVEYORS—
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting Machinery Co., Cleveland.
Webster Camp & Lane Machine Co., Akron, O.

COPPER GASKETS—
Drake Acetylene Apparatus Co., Cleveland, O.

CORE OVENS—
Millett Core Oven Co., Brightwood, Mass.

CORRESPONDENCE SCHOOLS—
International Correspondence Schools, Scranton, Pa.

CORRUGATED IRON—
Berger Mfg. Co., Canton, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
American Sheet Steel Co., New York City.

COTTON TIES—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.

CRANES—
Cleveland Punch & Shear Wks. Co., Cleveland.
Northern Engineering Works, Detroit, Mich.
Wm. Tod & Co., Youngstown, O.
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Torbert & Peckham, Chicago, Ill.
The Brown Hoisting Machinery Co., Cleveland.
Cleveland Crane & Car Co., Cleveland, O.
R. D. Wood & Co., Philadelphia, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.
Atlas Machine Co., Pittsburg, Pa.
S. Obermayer Co., Cincinnati, O., and Chicago.

CRANES AND DERRICKS—
A. Leschen & Sons Rope Co., St. Louis, Mo.

CRANK PINS—
Bethlehem Steel Co., S. Bethlehem, Pa.

CRUSHING MACHINERY—
Raymond Bros. Impact Pulverizer Co., Chicago.

CUPOLAS—
Riter-Conley Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
The United Boiler Co., Girard, O.
Wm. B. Pollock Co., Youngstown, O.
Whiting Foundry Equipment Co., Harvey, Ill.
S. Obermayer Co., Cincinnati, O., and Chicago, Ill.

DECALCOMANIAS—
Scientific Manufacturing Co., Chicago, Ill.

DIES—
Danielson Machine & Tool Co., Cleveland, O.
American Steel & Wire Co., Chicago, Ill.

DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
The Jeffrey Mfg. Co., Columbus, O.
Thew Automatic Shovel Co., Lorain, O.

DRILL GRINDERS—
J. Wendell Cole, Columbus, O.
Somers, Fitler & Clarke, Pittsburg, Pa.

DRILLING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

DRILL PRESSES—
Cleveland Punch & Shear Wks. Co., Cleveland.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

DROP FORGINGS—
Wyman & Gordon, Worcester, Mass.
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.
Frankford Steel & Forging Co., Philadelphia.
E. D. Clapp Mfg. Co., Auburn, N. Y.

DROP HAMMERS—
Cleveland Punch & Shear Wks. Co., Cleveland.

DROP PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
Danielson Machine & Tool Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland.
Bethlehem F'dry & Mach. Co., Bethlehem, Pa.

DYNAMOS—
Jeffrey Mfg. Co., Columbus, O.

EAVE TROUGHS AND CONDUCTORS—
Berger Mfg. Co., Canton, O.

ELECTRICAL MACHINERY SUPPLIES—
A. Leschen & Sons Rope Co., St. Louis, Mo.
Pelton Engineering Co., Cleveland, O.

ELECTRICAL WIRES AND CABLES—
American Steel & Wire Co., Chicago, Ill.

ELEVATING AND CONVEYING MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting Machinery Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O.
American Engineering Works, Chicago, Ill.

EMERY AND CORUNDUM WHEELS—
C. H. Besly & Co., Chicago, Ill.
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.
The Carborundum Co., Niagara Falls, N. Y.

EMERY WHEEL MACHINERY—
J. Wendell Cole, M. E., Columbus, O., or Chicago.
C. H. Besly & Co., Chicago, Ill.
Northampton Emery Wheel Co., Chicago, Ill.

ENGINEERS AND CONTRACTORS—
The Best Manufacturing Co., Pittsburg, Pa.
Wellman-Seaver Engineering Co., Cleveland, O
Walter Kennedy, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville.
E. E. Erickson, Pittsburg, Pa.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Julian Kennedy, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Alex. Laughlin & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
David Lamond, Pittsburg, Pa.
Pittsburg Steel Construction Co., Pittsburg, Pa.
Pittsburg Valve, Foundry & Construction Co., Pittsburg, Pa.
American Engineering Works, Chicago, Ill.

ENGINE PACKING—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill.

ENGINEERS' SUPPLIES—
C. H. Besly & Co., Chicago, Il.
Jenkins Bros., New York City.
Wright Mfg. Co., Cleveland, O.
Drake Acetylene Apparatus Co., Cleveland, O.
The Lunkenheimer Co., Cincinnati, O.
The Crane Co., Chicago, Ill.

ENGINE LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

ENGINES (Oil) —
The Aultman Co., Canton, O.

ENGINES (Steam)—
Wm. Tod & Co., Youngstown, O.
The Edward P. Allis Co., Milwaukee, Wis.
Somers, Fitler & Clarke, Pittsburg, Pa.
The Hooven, Owens & Rentschler Co., Hamilton, O.
The Aultman Co., Canton, O.
Vulcan Iron Works, Wilkes-Barre, Pa.
Wickes Bros., Pittsburg, Pa.

ENGRAVERS AND ELECTROTYPERS—
Rosenow & Co., Chicago, Ill.

FEED WATER HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

FELLOE PLATES—
Avery Stamping Co., Cleveland, O.

FILES, MAKERS OF—
C. H. Besly & Co., Chicago, Ill.

FILTER PRESSES—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

FILTERS—
Wm. B. Scaife & Sons, Pittsburg, Pa.
Pittsburg Filter Mfg. Co., Pittsburg, Pa.

FIRE BRICK AND CLAY—
J. V. Rose & Son, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield, Pa.
Dover Fire Brick Co., Cleveland, O.
F. B. Stevens, Detroit, Mich.
Chicago Fire Brick Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
F. B. Holmes & Co., Detroit, Mich.
Keystone Fire Clay Co., Lisbon, O.
Garden City Sand Co., Chicago, Ill.
A. F. Smith & Co., New Brighton, Pa.
A. J. Hawes & Son, Johnstown, Pa.
S. Obermayer Co., Cincinnati, O., and Chicago.
Scioto Fire Brick Co., Sciotoville, O.
Crown Fire Clay Co., Akron, O.
Reese-Hammond Fire Brick Co., Bolivar, Pa.
John H. Ehlen, Newport, Ky.

FIRE PROOF COVERING—
C. H. Besley & Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

FOOT AND POWER LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

FORGINGS—
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Cleveland City Forge & Iron Co., Cleveland, O
Bethlehem Steel Co., South Bethlehem, Pa.
Wyman & Gordon, Worcester, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Samuel Trethewey & Co., Pittsburg, Pa.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.
Frankford Steel & Forging Co., Philadelphia.
Pilling & Crane, Philadelphia, Pa.
Vulcanus Forging Co., Cleveland, O.
E. D. Clapp Mfg. Co., Auburn, N. Y.
Geo. B. Sennett Co., Youngstown, O.

FOUNDRIES—
Best Mfg. Co., Pittsburg, Pa.
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
Link Belt Machinery Co., Chicago, Ill.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Schuykill Iron & Steel Co., Philadelphia, Pa.
Wheeling Mold and Foundry Co., Wheeling, W. Va.
E. R. Allen, Corning, N. Y.
Pittsburg Valve, Foundry & Construction Co., Pittsburg, Pa.

FOUNDRY EQUIPMENT—
Tabor Mfg. Co., Philadelphia, Pa.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Cleveland Crane & Car Co., Cleveland, O.
S. Obermayer Co., Cincinnati, O., and Chicago.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Chicago Pneumatic Tool Co., Chicago, Ill.
Macleod & Clark, Cincinnati, O.
The W. J. Clark Co., Salem, O.
Millett Core Oven Co., Brightwood, Mass.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O.
S. Obermayer Co., Cincinnati, O., and Chicago.

FOUNDRY SUPPLIES—
Northern Engineering Works, Detroit, Mich.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co., Cleveland, O.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire Brick Co., Cleveland, O.
A. F. Smith & Co., New Brighton, Pa.
Tabor Mfg. Co., Philadelphia, Pa.
F. B. Stevens, Detroit, Mich.
Cleveland Facing Mill Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Brick Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
J. V. Rose & Son, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
F. B. Holmes & Co., Detroit, Mich.
A. J. Haws & Son, Johnstown, Pa.
Webster Foundry Sand Co., Philadelphia, Pa.
S. Obermayer Co., Cincinnati, O., and Chicago.
Scioto Fire Brick Co., Sciotoville, O.
Newport Sand Bank Co., Newport, Ky.
Crown Fire Clay Co., Akron, O.
Reese-Hammond Fire Brick Co., Bolivar, Pa.
John H. Ehlen, Newport, Ky.
Keystone Fire Clay Co., Lisbon, O.
Millett Core Oven Co., Brightwood, Mass.
Somers, Fitler & Clarke, Pittsburg, Pa.

FRICTION METAL—
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago, Ill.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FUEL OIL BURNERS—
Rockwell Engineering Co., New York City.

GAGE COCKS—
The Lunkenheimer Co., Cincinnati, O.

GALVANIZED IRON—
American Sheet Steel Co., New York City.
McCullough Iron Co., Wilmington, Del.

GALVANIZERS—
American Sheet Steel Co., New York City.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Northern Engineering Works, Detroit, Mich.
Columbus Machine Co., Columbus, O.
Atlas Machine Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

GAS PRODUCERS—
R. D. Wood & Co., Philadelphia, Pa.

GAUGES (Rolling Mill)—
Haines Gauge Co., Philadelphia, Pa.

GEARING—
I. & E. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
Link Belt Machinery Co., Chicago, Ill.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

GEAR CUTTERS—
F. H. Bultman & Co., Cleveland, O.

GEAR CUTTING—
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GIRDER WORK—
Wm. B. Scaife & Sons, Pittsburg, Pa.

GRINDING MACHINERY—
Raymond Bros. Impact Pulverizer Co., Chicago.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos. Dixon Crucible Co., Jersey City, N. J.

HACK SAWS—
Cleveland Punch & Shear Wks. Co., Cleveland.

HANGERS—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
I. & E. Greenwald Co., Cincinnati, O.
Link Belt Machinery Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
The United Boiler Co., Girard, O.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill.

HOISTS—
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HOISTING ENGINES—
The Edward P. Allis Co., Milwaukee, Wis.
Lidgerwood Mfg. Co., New York City.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Vulcan Iron Works, Wilkes-Barre, Pa.
Torbert & Peckham, Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

HOISTING MACHINERY—
Exeter Machine Works, Pittston, Pa.
Link-Belt Machinery Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
The Brown Hoisting Machinery Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.

HOISTING ROPE (Wire)—
American Steel & Wire Co., Chicago, Ill.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill.
American Steel & Wire Co., Chicago, Ill.

HYDRAULIC TOOLS—
R. D. Wood & Co., Philadelphia, Pa.

INDUSTRIAL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.
The Atlas Car & Mfg. Co., Cleveland, O.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.
Somers, Fitler & Clarke, Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Illinois Steel Co., Chicago, Ill.
Riter-Conley Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.
American Bridge Co., New York City.
Pittsburg Steel Construction Co., Pittsburg, Pa.

IRON, NAILS AND STEEL—
C. H. Besly & Co., Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
McCullough Iron Co., Wilmington, Del.

IRON ORE—
Lake Superior Consolidated Iron Mines, New York City, N. Y.
Ogiebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
M. A. Hanna & Co., Cleveland, O.
Drake, Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.
J. Wesley Pullman, Philadelphia, Pa.
Tod, Stambaugh & Co., Cleveland, O.
Jerome Keeley & Co., Philadelphia, Pa.

IRON WORKING MACHINERY—
Atlas Machine Co., Pittsburg, Pa.

IRON WORKING TOOLS—
Avery Stamping Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
F. H. Bultman & Co., Cleveland, O.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Bertsch & Co., Cambridge City, Ind.
Thos. P. Conard, Philadelphia, Pa.
C. C. Wormer Machinery Co., Detroit, Mich.
Carlin Machinery & Supply Co., Allegheny, Pa.
Bethlehem F'dry & Mach. Co., S. Bethlehem, Pa
Jos. K. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Springfield Machine Tool Co., Springfield, O.
Pratt Chuck Co., Frankfort, N. Y.
Somers, Fitler & Clarke, Pittsburg, Pa.

LADLES—
Northern Engineering Works, Detroit, Mich.
The United Boiler Co., Girard, O.
The W. J. Clark Co., Salem, O.
Wm. B. Pollock Co., Youngstown, O.
Whiting Foundry Equipment Co., Harvey, Ill.
S. Obermayer Co., Cincinnati, O., and Chicago.

LAG SCREWS—
Vulcanus Forging Co., Cleveland, O.

LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Springfield Machine Tool Co., Springfield, O.
Joseph E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

LATHE TOOLS—
Armstrong Bros Tool Co., Chicago, Ill.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.

LOCOMOTIVES—
Hyde Bros. & Co., Pittsburg, Pa.

LUBRICANTS—
The Ironsides Co., Columbus, O.

LUBRICATING DEVICES—
The Lunkenheimer Co., Cincinnati, O.
Somers, Fitler & Clarke, Pittsburg, Pa.

MACHINE TOOLS—
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland.
Wickes Bros., Pittsburg, Pa.
Carlin Machinery & Supply Co., Allegheny, Pa.
C. C. Wormer Machinery Co., Detroit, Mich.
Bethlehem F'dry & Mach. Co., S. Bethlehem, Pa
Pelton Engineering Co., Cleveland, O.
Atlas Machine Co., Pittsburg, Pa.
Joseph E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
F. B. Shuster Co., New Haven, Conn.
Somers, Fitler & Clarke, Pittsburg, Pa.
Springfield Machine Tool Co., Springfield, O.
American Engineering Works, Chicago, Ill.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

MACHINERY AND TOOL STEEL—
C. H. Besly & Co., Chicago, Ill.
Crescent Steel Co., Pittsburg, Pa.
Byron H. White, Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.

MALLEABLE CASTINGS—
Acme Steel & Malleable Iron Works, Buffalo, N. Y.
Link Belt Machinery Co., Chicago, Ill.
Meadville Malleable Iron Co., Meadville, Pa.

MANILLA ROPE—
A. Leschen & Sons Rope Co., St. Louis, Mo.

MANILLA ROPE COATING—
The Ironsides Co., Columbus, O.

MANUFACTURING CHEMISTS—
Grasselli Chemical Co., Cleveland, O.

METAL BEARINGS—
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL SAWS—
J. R. Vandyck, New York City, N. Y.

METAL WORK—
Avery Stamping Co., Cleveland, O.

MILL CASTINGS—
Schuylkill Iron & Steel Co., Philadelphia, Pa.
A. Garrison Foundry Co., Pittsburg, Pa.

MILLING MACHINES—
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MILLING MACHINERY—
Raymond Bros. Impact Pulverizer Co., Chicago.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Exeter Machine Works, Pittston, Pa.
Wm. Cramp & Sons, Philadelphia, Pa.
The Atlas Car & Mfg. Co., Cleveland, O.
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Wm. B. Pollock Co., Youngstown, O.
Link Belt Machinery Co., Chicago, Ill.
Thew Automatic Shovel Co., Lorain, O.
Torbert & Peckham, Chicago, Ill.
A. Leschen & Sons Rope Co., St. Louis, Mo.
Carlin Machinery & Supply Co., Allegheny, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.
Raymond Bros. Impact Pulverizer Co., Chicago.
American Engineering Works, Chicago, Ill.

MINE LOCOMOTIVES—
Jeffrey Manufacturing Co., Columbus, O.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Torbert & Peckham, Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

MOLDING MACHINES—
Tabor Mfg. Co., Philadelphia, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.
S. Obermayer Co., Cincinnati, O., and Chicago.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Webster Foundry Sand Co., Philadelphia, Pa.
Newport Sand Bank Co., Newport, Ky.
S. Obermayer Co., Cincinnati, O., and Chicago.
John H. Ehlen, Newport, Ky.

MULTIPLE DRILLS—
Bickford Drill & Tool Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co., Cleveland.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS (SELF LOCKING)—
National Elastic Nut Co., Milwaukee, Wis.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O.
National Elastic Nut Co., Milwaukee, Wis.
Milton Manufacturing Co., Milton, Pa.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
Rockwell Engineering Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.
The Crane Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
The Lunkenheimer Co., Cincinnati, O.

OIL STORAGE TANKS—
Wm. B. Pollock Co., Youngstown, O.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia.

OIL TANKS AND CARS—
Wm. B. Pollock Co., Youngstown, O.

ORE BARROWS—
The Atlas Car & Mfg. Co., Cleveland, O.

ORE CARS—
The Pressed Steel Car Co., Pittsburg, Pa.
The Atlas Car & Mfg. Co., Cleveland, O.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.

ORE HANDLING MACHINERY—
A. Leschen & Sons Rope Co., St. Louis, Mo.
The Atlas Car & Mfg. Co., Cleveland, O.
Jeffrey Manufacturing Co., Columbus, O.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

ORE TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
A. Leschen & Sons Rope Co., St. Louis, Mo.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
The Ironsides Co., Columbus, O.

PAINT MACHINES—
Cleveland Pneumatic Tool Co., Cleveland, O.
Chicago Pneumatic Tool Co., Chicago, Ill.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland, O.
Forsythe Pattern Works, Youngstown, O.
C. Birnbaum, Cleveland, Ohio.
Balkwill Pattern Works, Cleveland, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PIG IRON—
Cabeen Co., Philadelphia, Pa.
Reed F. Blair & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
Bourne-Fuller Co., Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich.
Spearman Iron Co., Sharpsville, Pa.
Hickman, Williams & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
J. H. Hillman & Son, Pittsburg, Pa.
Pilling & Crane, Philadelphia Pa.
Sloss Sheffield Steel & Iron Co., Birmingham, Ala.
Cherry Valley Iron Co., Pittsburg, Pa.
Jerome Keeley & Co., Philadelphia, Pa.
American Steel & Wire Co., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Alabama Consolidated Coal & Iron Co., Birmingham, Ala.
A. M. Crane & Co., Chicago, Ill.
The Rob't Field Co., Columbus, O.

PIPE (CAST IRON)—
Massillon Iron & Steel Co., Chicago, Ill.
A. M. Crane & Co., Chicago, Ill.

PIPE (RIVETED STEEL)—
Wm. B. Scaife & Sons, Pittsburg, Pa.
Wm. B. Pollock Co., Youngstown, O.
A. M. Crane & Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn.
Somers, Fitler & Clarke, Pittsburg, Pa.

PIPE FITTERS—
The Best Manufacturing Co., Pittsburg, Pa.
Pittsburg Valve, Fdy. & Construc. Co., Pittsburg, Pa.

PISTON AIR DRILLS—
Cleveland Pneumatic Tool Co., Cleveland, O.
Chicago Pneumatic Tool Co., Chicago, Ill.

PISTON RODS—
Bethlehem Steel Co., South Bethlehem, Pa.

PLANERS—
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Atlas Machine Co., Pittsburg, Pa.
Springfield Machine Tool Co., Springfield, O.
Somers, Fitler & Clarke, Pittsburg, Pa.

PLANER TOOLS—
Armstrong Bros. Tool Co., Chicago, Ill.

PLANISHED IRON—
American Sheet Steel Co., New York City.

PLATES—
Enterprise Boiler Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Illinois Steel Co., Chicago, Ill.
American Steel & Wire Co., Chicago, Ill.
A. M. Crane & Co., Chicago, Ill.

PLUMBERS' AND GAS FITTERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
The Crane Co., Chicago, Ill.

PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York.
W. J. Schaefer Co., New York City.

PNEUMATIC TOOLS—
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
American Engineering Works, Chicago, Ill.

PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
Vulcan Mfg. Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

POWER PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
Cleveland Punch & Shear Wks. Co., Cleveland.
Danielson Machine & Tool Co., Cleveland, O.
Bethlehem F'dry & Mach. Co., S. Bethlehem, Pa.

POWER TRANSMISSION MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
I. & E. Greenwald Co., Cincinnati, O.
Link Belt Machinery Co., Chicago, Ill.
A. Leschen & Sons Rope Co., St. Louis, Mo.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
Danielson Machine & Tool Co., Cleveland, O.
Avery Stamping Co., Cleveland, O.
Bethlehem F'dry & Mach. Co., S. Bethlehem, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland.
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Southwark Foundry & Machine Co., Philadelphia, Pa.
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American Steel Hoop Co., New York City.
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Garden City Sand Co., Chicago, Ill.
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RIVETERS—
R. D. Wood & Co., Philadelphia, Pa.

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Cleveland Pneumatic Tool Co., Cleveland, O.
Chicago Pneumatic Tool Co., Chicago, Ill.

RIVETING MACHINES—
Chicago Pneumatic Tool Co., Chicago, Ill.

ROCK CRUSHERS—
Raymond Bros. Impact Pulverizer Co., Chicago.

ROCK DRILLS—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

ROLL FORGINGS—
Samuel Trethewey & Co., Pittsburg, Pa.
Frankford Steel & Forging Co., Philadelphia.

ROLLING MILL MACHINERY—
The United Boiler Co., Girard, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
West Penn Foundry & Machine Co., Avonmore, Pa.
Frank-Kneeland Machine Co., Pittsburg, Pa.
A. Garrison Foundry Co., Pittsburg, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.
Canton Roll & Machine Co., Canton, O.
Geo. B. Sennett Co., Youngstown, O.

ROOFS—
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.
McCullough Iron Co., Wilmington, Del.
American Bridge Co., New York City.
Pittsburg Steel Construction Co., Pittsburg, Pa.

ROPE AND CORDAGE—
Waterbury Rope Co., New York City.
Link Belt Machinery Co., Chicago, Ill.
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Cleveland Pneumatic Tool Co., Cleveland, O.
Chicago Pneumatic Tool Co., Chicago, Ill.

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J. R. Vandyck, New York City, N. Y.

SAWS—
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SCRAP IRON—
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Illinois Steel Co., Chicago, Ill.
Joseph Schonthal, Pittsburg, Pa.
A. M. Crane & Co., Chicago, Ill.

SCREENS FOR COAL, ORE, ETC.
Robt. Aitchison Perforated Metal Co., Chicago.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.

SCREWS—
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Upson Nutt Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill.

SECOND-HAND MACHINERY—
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The Atlas Machine Co., Pittsburg, Pa.
The W. J. Carlin Co., Pittsburg, Pa.
C. C. Wormer Machinery Co., Detroit, Mich.
Carlin Machinery & Supply Co., Allegheny, Pa.
Pelton Engineering Co., Cleveland, O.
Torbert & Peckham, Chicago, Ill.
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American Steel & Wire Co., Chicago, Ill.
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Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Atlas Machine Co., Pittsburg, Pa.
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SHEARING AND PUNCHING MACHINERY—
Bertsch & Co., Cambridge City, Ind.
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Springfield Machine Tool Co., Springfield, O.

SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SHEET IRON AND STEEL—
Republic Iron & Steel Co., Chicago, Ill.
American Sheet Steel Co., New York City.
American Steel & Wire Co., Chicago, Ill.

SHEET METAL WORK—
The W. J. Clark Co. Salem, O.

SHIP YARDS—
Wm. Cramp & Sons, Philadelphia, Pa.

SOLID STEEL SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SPECIAL MACHINERY—
Cleveland Punch & Shear Wks. Co., Cleveland.
Avery Stamping Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Wheeling Mold & F'ndry Co., Wheeling, W. Va.
Danielson Machine & Tool Co., Cleveland, O.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.

STACKS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

STAND PIPES—
The Wm. B. Pollock Co., Youngstown, O.
The United Boiler Co., Girard, O.

STEAM AND GAS FITTERS' TOOLS—
The Crane Co., Chicago, Ill.

STEAM BOILER INSPECTORS—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

STEAM HAMMERS—
American Engineering Works, Chicago, Ill.

STEAM PIPE AND BOILER COVERING—
C. H. Besly & Co. Chicago, Ill.

STEAM PACKING—
C. H. Besly & Co., Chicago, Ill.

STEAM PUMPS—
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
The Deming Co., Salem, O.
R. D. Wood & Co., Philadelphia, Pa.
Wickes Bros, Pittsburg, Pa.
Torbert & Peckham, Chicago, Ill.

STEAM SEPARATORS—
Harrison Safety Boiler Works, Philadelphia.
Wright Manufacturing Co., Cleveland, O.

STEAM SHOVELS AND DREDGES—
Marion Steam Shovel Co., Marion, O.
Torbert & Peckham, Chicago, Ill.
The Bucyrus, Co., South Milwaukee, Wis.
The Thew Automatic Shovel Co., Lorain, O.

STEAM SPECIALTIES—
C. H. Besly & Co., Chicago, Ill.
The Crane Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.

STEEL—
Otis Steel Co., Cleveland, O.
Cabeen Co., Philadelphia, Pa.
Crescent Steel Co., Pittsburg, Pa.
Byron H. White, Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
A. M. Crane & Co., Chicago, Ill.
Champion Iron & Steel Co., Muskegon, Mich.

STEEL BANDS—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.

STEEL BLOOMS AND BILLETS—
American Steel & Wire Co., Chicago, Ill.
Cabeen Co., Philadelphia, Pa.
National Steel Co., Chicago, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.
The Lorain Steel Co., Lorain, O.
American Steel Hoop Co., Pittsburg, Pa.
Jerome Keeley & Co., Philadelphia, Pa.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Champion Iron & Steel Co., Muskegon, Mich.
A. M. Crane & Co., Chicago, Ill.

STEEL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

STEEL CASTINGS—
Otis Steel Co., Cleveland, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Acme Steel & Malleable Iron Works, Buffalo, N. Y.
The Sargent Co., Chicago, Ill.

STEEL CEILINGS—
Berger Manufacturing Co., Canton, O.

STEEL FRAME MILL BUILDINGS—
Wm. B. Scaife & Sons, Pittsburg, Pa.
American Bridge Co., New York City.
Pittsburg Steel Construction Co., Pittsburg, Pa.

STEEL HOOPS—
American Steel Hoop Co., Pittsburg, Pa.

STEEL PLANTS—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.

STEEL SHEETS—
Republic Iron & Steel Co., Chicago, Ill.
American Sheet Steel Co., New York City.
American Steel & Wire Co., Chicago, Ill.

STEEL STAMPS—
F. A. Sackmann, Cleveland, O.

STENCILS—
F. A. Sackmann, Cleveland, O.

STOCKS AND DIES—
The Crane Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

TANKS—
Enterprise Boiler Co., Youngstown, O.
Meehan Boiler & Construction Co., Lowellville, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
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Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
The United Boiler Co., Girard, O.

TANK CARS—
Wm. B. Pollock Co., Youngstown, O.

TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

TIN AND TERNE PLATES—
American Tin Plate Company, New York City.
Champion Iron & Steel Co., Muskegon, Mich.

TIN PLATE MACHINERY—
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
West Penn Foundry & Machine Co., Avonmore, Pa.
Canton Roll & Machine Co., Canton, O.

TOOL HOLDERS—
Armstrong Bros. Tool Co., Chicago, Ill.

TOOL STEEL—
C. H. Besly & Co., Chicago, Ill.
Crescent Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

TORCHES—
Somers, Fitler & Clarke, Pittsburg, Pa.

TRAMWAYS—
The Atlas Car & Mfg. Co., Cleveland, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.

TRANSMISSION MACHINERY—
Link Belt Machinery Co., Chicago, Ill.
W. A. Jones Foundry & Machine Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
The Brown Hoisting Machinery Co., Cleveland, O.

TRANSMISSION ROPE (WIRE)—
American Steel & Wire Co., Chicago, Ill.

TROLLEY TRACKS—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
The Atlas Car & Mfg. Co., Cleveland, O.

TROLLEY WIRES—
American Steel & Wire Co., Chicago, Ill.

TRUCKS—
Northern Engineering Works, Detroit, Mich.
The Atlas Car & Mfg. Co., Cleveland, O.

TUBES—
National Tube Co., Pittsburg, Pa.
S. Fix' Sons, Cleveland, O.

TUBE WELDING—
S. Fix' Sons, Cleveland, O.

TUMBLERS—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

TURBINE WATER WHEELS—
Stilwell-Bierce & Smith Vaile Co., Dayton, O.

TURNBUCKLES—
Republic Iron & Steel Co., Chicago, Ill.
Ceveland City Forge & Iron Co., Cleveland, O
Somers, Fitler & Clarke, Pittsburg, Pa.

TWIST DRILLS—
C. H. Besly & Co., Chicago, Ill.

TWIST DRILL CASES—
Vulcan Mfg. Co., Pittsburg, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

VALVES—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Pittsburg Valve Foundry & Construction Co., Pittsburg, Pa.
The Crane Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.
Somers, Fitler & Clarke, Pittsburg, Pa.
The Best Manufacturing Co., Pittsburg, Pa.

WASHERS—
Avery Stamping Co., Cleveland, O.
Milton Manufacturing Co., Milton, Pa.
Somers, Fitler & Clarke, Pittsburg, Pa.

WATER COLUMNS—
Somers, Fitler & Clarke, Pittsburg, Pa.

WATER PIPE—
Massillon Iron & Steel Co., Chicago, Ill.

WATER SOFTENING PLANTS—
Pittsburg Filter Mfg. Co., Pittsburg, Pa.

WIRE—
American Steel & Wire Co., Chicago, Ill.
Summit Wire Co., Cuyahoga Falls, O.

WIRE COATING—
The Ironsides Company, Columbus, O.

WIRE FENCING—
American Steel & Wire Co., Chicago, Ill.

WIRE FILLER—
The Ironsides Co., Columbus, O.

WIRE MACHINERY—
S. W Goodyear, Waterbury, Conn.
F. B. Shuster Co., New Haven, Conn.

WIRE NAILS—
American Steel & Wire Co., Chicago, Ill.

WIRE ROPE—
Waterbury Rope Co., New York City.
A. Leschen & Sons Rope Co., St. Louis, Mo.
American Steel & Wire Co., Chicago, Ill

WIRE ROPE COATING—
The Ironsides Company, Columbus, O.
Somers, Fitler & Clarke, Pittsburg, Pa.

WIRE ROAP FILLING—
The Ironsides Co., Columbus, O.

WOOD PULLEYS—
Dodge Mfg. Co., Mishawaka, Ind.
Somers, Fitler & Clarke, Pittsburg, Pa.

WROUGHT PIPE—
National Tube Co., Pittsburg, Pa.
Pittsburg Valve Foundry & Construction Co., Pittsburg, Pa.
The Crane Co., Chicago, Ill.
Somers, Fitler & Clarke, Pittsburg, Pa.

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Gerlach, Peter & Co	35
Gobeille Pattern Co	42
Goodyear, S. W	37
Grasselli Chemical Co	35
Greenwald Co., I & E	29
Haines Gauge Co	2
Hall, R. C	25
Hanna & Co., M. A	43
Harrisburg Foundry & Machine Works	52
Harrison Safety Boiler Works	23
Hartford Steam Boiler Insp. & Ins. Co	32
Haws & Sons, A. J	45
Hendrick Mfg. Co., The	39
Hickman, Williams & Co	43
Hiertz & Son, Theo	2
Hillman & Son, J H	1
Holmes & Co., F. B	44
Hooven, Owens & Rentschler Co	33
Hunt & Co., Robt. W	2
Hyde Bros. & Co	52
Illinois Steel Co	52
Ingersoll-Sergeant Drill Co	2
International Correspondence Schools	44
Iron Clad Paint Co	41
Ironsides Co	25
Jeffrey Mfg. Co	44
Jenkins Bros	31
Jones Foundry & Machine Co., W. A	1
Keeley & Co., Jerome	25
Kennedy, Julian	39
Kennedy, Walter	39
Kentucky Fire Brick Works	26
Keystone Driller Co	42
Keystone Fire Clay Co., The	44
Lake Superior Consolidated Iron Mines	43
Lamond, David	39
Laughlin & Co., Alex	39
Leschen & Sons Rope Co., A	37
Lidgerwood Mfg. Co	38
Link-Belt Machinery Co	38
Lorain Foundry Co	40
Lorain Steel Co	51
Lunkenheimer Co., The	31
Marion Steam Shovel Co	60
Massillon Iron & Steel Co	35
McKeefrey & Co	43
Meadville Malleable Iron Co	2
Meehan Boiler & Construction Co	60
Millet Core Oven Co	36
Milton Manufacturing Co	48
Monongahela Iron & Steel Co	35
National Elastic Nut Co	37
National Steel Co	48
National Tube Co	48
†Newport Sand Bank Co	—
Northampton Emery Wheel Co	33
Northern Engineering Co	38
Nuttall Co., The R. D	33
Oak Hill Fire Brick & Coal Co	26
Obermayer Co., S	28
O'Gara, King & Co	42
Oglebay, Norton & Co	43
†Ohio Sand Co	—
Otis Steel Co	25
Pelton Engineering Co	52
Perfect Lubricating Metal Co	60
Phœnix Horse Shoe Co	26
Pickands, Brown & Co	43
Pickands, Mather & Co	43
Pilling & Crane	1
Pittsburg Filter Mfg. Co	53
Pittsburg Steel Construction Co	2
Pittsburg Valve, Foundry & Construction Co	36
Pollock Co., The Wm. B	2
Pratt Chuck Co	37
Prescott Steam Pump Co	32
Pressed Steel Car Co., The	47
*Pullman, J. Wesley	—
Rand Drill Co	2
Raymond Bros. Impact Pulverizer Co	2
Reese-Hammond Fire Brick Co	44
Republic Iron & Steel Co	1-51
Riter-Conley Mfg. Co	39
*Rockwell Engineering Co	1—
Rosenow & Co	35
Ryan, J. J. & Co	60
Sackmann, F. A	34
Sargent Co., The	30
Scaife & Sons, Wm. B	59
Schonthal, Joseph	52
Schuylkill Iron & Steel Co	59
Scientific Manufacturing Co	39
Scioto Fire Brick Co	45
Scioto Star Fire Brick Works	45
Seaman, Sleeth Co	40
Sennett Co., Geo. B	29
‖Sharon Fire Brick Works	1
Shuster Co., F. B	34
Sloss Iron & Steel Co	47
Sloss Sheffield Steel & Iron Co	47
Smith & Co., A. F	45
Somers, Fitler & Clarke	1
Southwark Foundry & Machine Co	29
Spearman Iron Co	60
Springfield Machine Tool Co	1
Standard Chain Co	44
Stevens, F. B	60
Stilwell-Bierce & Smith-Vaile Co	1-24
Summit Wire Co	50
*Superior Charcoal Iron Co	27
*Tabor Mfg. Co	—
Tennessee Coal, Iron & Railroad Co	47
Textor, O	2
Thew Automatic Shovel Co., The	2
Tod, Stambaugh & Co	43
Tod, Wm. & Co	29
Torbert & Peckham	52-53
Totten & Hogg Iron & Steel Foundry Co	40
Trethewey & Co., Ltd., Samuel	35
Union Mining Co	25
United Boiler Co	39
United States Telephone Co	2
Upson Nut Co	1
Van Dorn & Dutton Co	33
Vandyck, J. R	28
*Vulcan Iron Works	37
Vulcan Mfg. Co	35
*Vulcanus Forging Co	34
Waterbury Rope Co	39
Webster, Camp & Lane Machine Co	26
Webster Fire Brick Co	1
Webster Foundry Sand Co	45
Wellman-Seaver Engineering Co	39
West Penn Foundry & Machine Co	41
Wheeling Mold & Foundry Co	60
White, Byron H	35
Whiting Foundry Equipment Co	38
Wickes Bros	52
Wood & Co., R. D	28
Wormer Machinery Co., C. C	52
Wright Manufacturing Co	53
Wyman & Gordon	59